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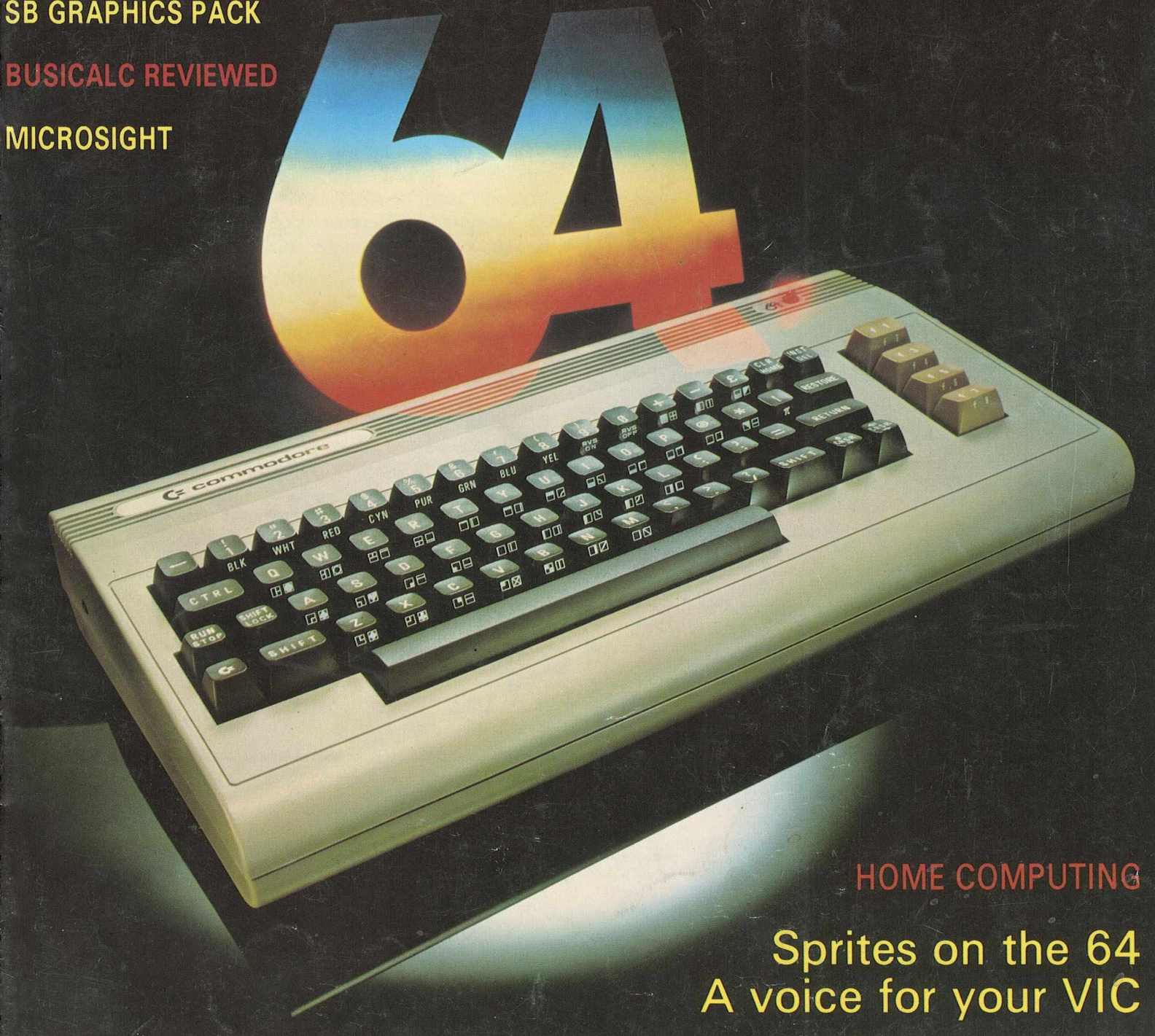


HOME COMPUTING

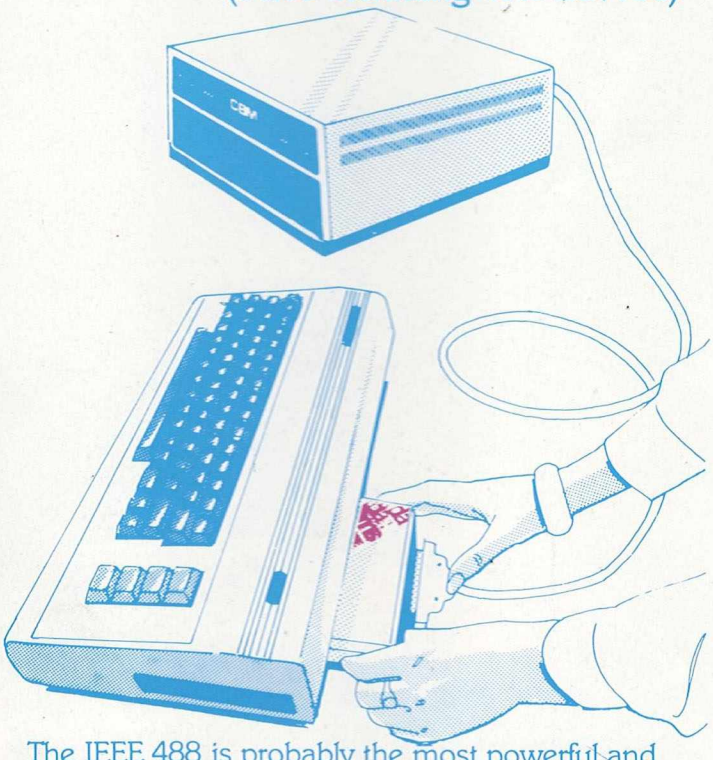
Sprites on the 64
A voice for your VIC

The independent magazine for Commodore computer users

VIC 20/ COMMODORE 64 IEEE INTERFACE

Only £49.95 + VAT

(Price including VAT £57.44)



The IEEE 488 is probably the most powerful and flexible of all interfaces and at DAMS we have now harnessed it into a special cartridge, which plugs easily into the back of your VIC 20 or Commodore 64 computer, allowing for the connection of all peripherals previously associated with the PET range to the VIC!

This new and revolutionary step has enormous benefits for the scientific or educational user. Most electronic instruments can be interfaced, via IEEE to 64, and in a classroom situation up to 15 VIC/64 computers can be connected to one central disk drive.

So, almost immediately, your 64 is transformed from a basic, home computer, into a sophisticated scientific and technical tool, with access to all PET peripherals, hard disk drives with up to 30 megabytes of memory, and up to 15 separate devices.

The IEEE automatically reconfigures the VIC 20/64 to input/output use, it allows simultaneous use of the VIC/64 serial bus, uses the standard PET/IEEE cable, and plugs directly into the VIC/64 memory expansion port. No software changes are necessary, and the cartridge comes with a full, 12 months guarantee for, only **£49.95 + VAT.**

COMMODORE 64, IEEE INTERFACE

The Commodore 64 version contains all of the benefits associated with the VIC 20, but also has:

- Automatically relocating code to allow plug-in cartridge programs.
- Reproduction of Commodore 64's memory expansion slot to allow you to use ROM based business software.

DAMS 12 MONTH GUARANTEE

DAMS Office Equipment Ltd. (hereinafter called the 'company') warrants the products it sells against defects in material and workmanship for a period of one year from the date of purchase.
During the warranty period, the company will repair (or at its own option, replace) at no charge, components that prove defective. This is provided the product is returned, shipping pre-paid, or by person, to Gores Road, Kirkby Industrial Estate, Kirkby, Liverpool L33 7AU, stating when it was bought and enclosing proof of purchase.
This Warranty does not apply if, in the opinion of the company, the product has been damaged by accident, misuse or misapplication.

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Please send me _____ (Qty) IEEE interface(s)
@ £57.44 each (inc. VAT + P&P) for my VIC/64*
I enclose cheque/P.O. for £ _____
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April 1983

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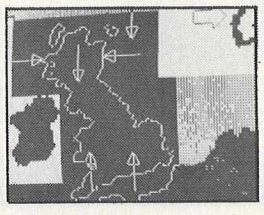

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HOME COMPUTING

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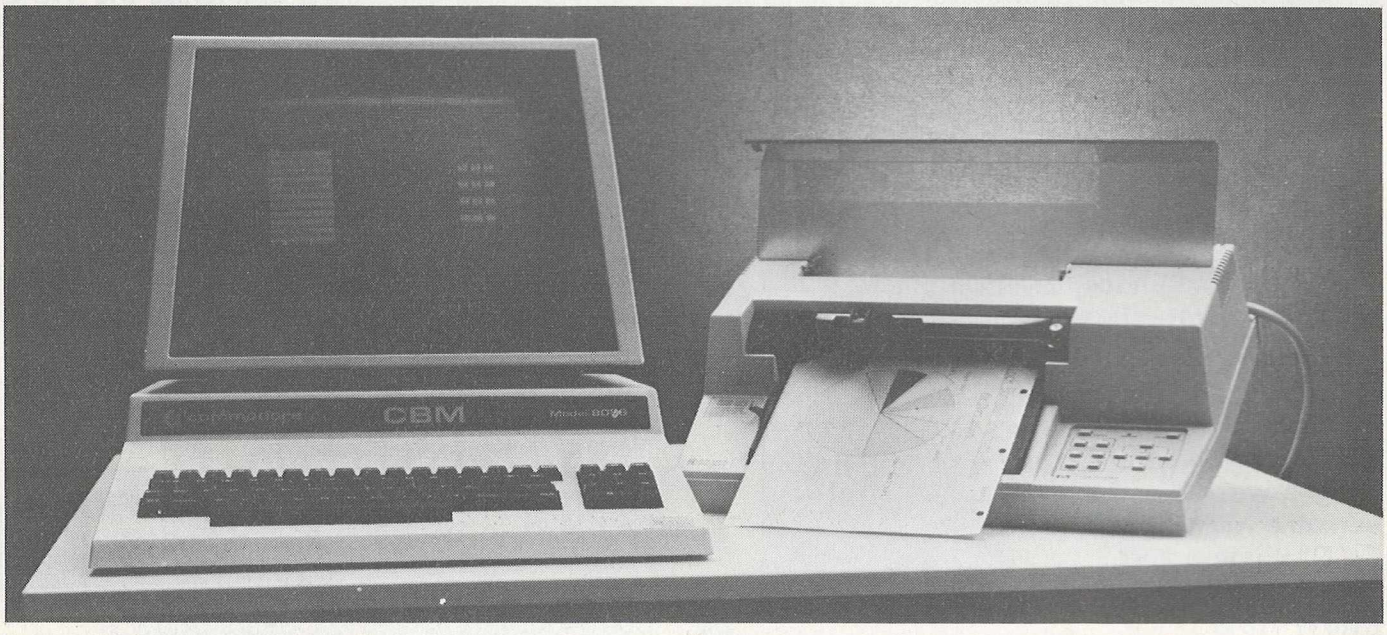
Extremely User-Friendly: no previous experience in computer-graphics needed



Designed exclusively for use with the (Commodore Business Machines) 8032 Computers and the Hewlett-Packard HP 7470 Graphics Plotter.

Wide Choice of Options

* Pye Charts
* Line and Bar Graphs
* Text Mode
* Drawing Mode
* Digitising Reproduction Mode

As soon as you acquire this superb Pack, comprising a 5.¼ inch floppy program disk and a special security dongle, you have a whole range of graph-creating facilities available via your CBM keyboard. Simply by keying in data, you can create pie charts, line graphs and bar charts (histograms). In addition, the Pack features programs for drawing polygons, rectangles, circles and ovals – plus virtually any other shape you wish, using the optional digitising pen.

Sumlock has made this software package extremely user-friendly and no previous experience with computer graphics is needed to obtain your first chart within 15 minutes after studying the easy-to-read, step-by-step instructions in the Manual. Just follow the menus and the plain English control procedures to select the options you want, then insert the data requested by each screen . . . it's as simple as that!

Sumlock Graphics Package
Please send me further information about the Sumlock Bondain Graphics Pack.
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Address _____
_____
_____
Telephone Number _____

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Study time

Experts and beginners alike are well catered for in the 1983 crop of computer courses

Among the many computer courses scheduled for 1983 are those organised by Coventry Management Training Centre, lasting from one day to three weeks. The course titles include 'Computers for Managers', 'Micro-programming', 'Micros in Business', 'Improving Office Systems' and 'Understanding Computers'.

Fees range from £86.25 to £690 including VAT. All the courses can be conducted in-company and can be adapted to company requirements. Further details from Coventry & District Engineering Employers' Association, Management Training Centre, Woodland Grange, Leamington Spa CV32 6RN (telephone 0926-36621).

At the South Bank Polytechnic, London, the open school run by the Microcomputer Advisory Centre is offering an introductory course. Although there will be a few timetabled talks, there will be no formal class program, so that students can spend as much time as they wish on their own interests. They can learn to program business or microcomputers and assess the value of computing techniques.

The introductory course costs £45 and the school is open throughout the college academic year. Write to South Bank Polytechnic, Microcomputer Advisory Centre, Borough Road, London SE1 0AA (telephone 01-928 8989).

Variety

For those involved in more serious programming, Chart Tutors and the Computer Training and Education Centre are presenting a three-week course in book-keeping and programming in Basic. The course is split into two modules, module one covering the first two weeks and topics like fundamental accounting concepts, books of prime entry and credit control procedures. Module two students will learn how to adapt the elements of the old accounting system to the new one.

The course dates are August 1-19 and November 7-25. The fee is £575 including VAT, 10 per cent of which is required on enrolment. Further information from Chart Tutors, 53 Great Sutton Street, London EC1V 0DQ (telephone 01-251 4981) or Computer Training and Education Centre, 102-108 Clerkenwell Road, London EC1M 5SA (telephone 01-251 4010).

The University College at Buckingham has a variety of courses running throughout the year, the length and cost depending on the course taken. 'Introduction to Computers and Word Processors', for example, is a two-day seminar costing £145. The address is Business Computing Courses, The University College at Buckingham, Buckingham MK18 1EG.

Frost and Sullivan have announced a seminar called 'Microcomputers in Corporate Information Systems', to be held at the Cumberland Hotel, London on April 25/26/27. The subject is how to select, implement and manage a micro system. Other seminars in April will be 'Understanding and Using CAD/CAM' and 'Understanding and Using Computer Business Graphics'. Frost and Sullivan Ltd are at 104-112 Marylebone Lane, London W1M 5FU (telephone 01-486 0334/5).

Conference on specialisation

'Specialisation as the key to success in computing services' is the topic of a conference to be held in Venice by the European Computing Services Association. Scheduled for April 20-22, it will cover the trend towards vertical marketing in industry, one company doing its own manufacturing, advertising, distributing and more. Speakers will discuss car dealership, soliciting, medicine, accountancy, tourism and the property business.

The venue is the San Rocco Art Gallery; at least 250 delegates are expected to attend, plus families and members of the press. The fee for ECSA members is £195 and for non-members £240, which includes participation documentation, coffee, luncheons and a cocktail party. It does not include accommodation provided by eight hotels, for which the ECSA Secretariat can secure a discount. The speeches will be simultaneously translated from English into Italian and vice versa.

For more details, contact the European Computing Services Association, Hanover House, 73/74 High Holborn, London EC1V 6LE (telephone 01-405 2171/3161).

Changes for Biggs

Jeremy Biggs, previously of USP Communications, has changed the name of his company, address and telephone number. He is now based at Communications, Holwood House, Holwood Road, Bromley, Kent (telephone 01-290 6044).

Compiler for the 64

The DTL Basic Compiler has been available for Commodore computers for some time. Now Dataview have released new versions for the 64 as well as the 500 and 700 series.

For the 64 the compiler comes on a tape or disk and enables compiled programs to be run up to 25 times faster. It also reduces their size by up to 80 per cent and, according to the makers, is 100 per cent compatible with the Basic Interpreter.

For the 500 and 700 series, the run times for compiled programs are up to 55 times faster and both of these versions can be used in conjunction with the Basic 4 Plus. For all those machines which are fitted with the CP/Maker, yet another version of the compiler enables the 64K RAM to be used as long as the DTL System 96 has also been installed in the machine. Whichever version you need, the compiler is priced at £99.50.

Area: *Compilers.*
Company: *Dataview.*
Address: *Portreeves House, East Bay, Colchester, Essex CO1 2XB.*
Tel: *0206-869414/865835.*

Educational cassettes

System Two Ltd are producing three educational programs on cassette for the VIC-20, 64, 510 and 700. The programs explain the techniques of computing to businessmen. The first program, 'Forward Fast', is an introduction to computers and the other two will deal with business micros and home and personal micros.

According to Luke Thornton, producer of the programs for System Two, the cassettes will be available from public libraries, computer manufacturers and distributors, schools, colleges and video outlets.

Area: *Education.*
Company: *System Two Ltd.*
Address: *No. 3 Woking Business Park, Albert Drive, Woking, Surrey GU21 5JY.*
Tel: *04862-27676.*

Smart workplaces

IDA are the UK agents for a firm called Gutmann who have designed a series of workplaces for the Commodore computer range. The desks can be either stationary or on castors and there are several designs from which to choose. The basic table, which comes without the ledge for the floppy disk or printer, measures 115 × 62 × 72cm and costs £116.

The tables are made of wood coated with pearl white and metal lacquered brown. Along with adjustable feet, the tables can accommodate other accessories, the prices of which are not included in that of the table. There are several types of form stand to cope with the different sizes of paper, prices ranging from £70 to £100. A copy holder is available at £60 and there is also a range of cabinets with differing drawers from £172 to £196.

Area: *Software accessories.*
Company: *International Data Automation Ltd.*
Address: *11 Station Parade, Virginia Water, Surrey GU25 4AB.*
Telephone: *09904-4944.*

Multiple interface

If you feel that the serial bus system employed in the VIC-20 and 64 has denied you access to any Commodore peripherals, then Interpod is for you: a multiple interface which enables the 20 and 64 to communicate with the entire range of Commodore peripherals and all IEEE and RS232 equipment. According to Oxford Computer Systems (Hensington Road, Woodstock, Oxford OX7 1JR, tel: 0993-812700), the product is compatible with any software.

Interpod fits directly into the serial port without affecting the memory, while increasing the power of both systems. Whereas previously the user may have been limited to disc drive, he can now turn his hand to printing, word processing, accounting and instrument control. Considering its versatility, the price of £125 is reasonable.

NEW PRODUCTS

Kobra Micro Marketing have launched a range of superb products for the Commodore 8000, 64 and Vic-20.

CALC RESULT
— new more powerful spread sheet for 8000 and 64

A new **THREE** dimensional spread sheet analysis package. Calc Result includes up to 32 pages per model, with full page consolidation features, advanced formatting of both the screen and printer, an easy to use **HELP** function, protection of mathematical formulas, and **BAR CHARTS** on the screen and printer. (**PIE CHARTS** available on the 64).

'8000'	£149.00
'64'	£ 95.00

PAPER CLIP
— fantastic value powerful wordprocessor for 8000, 4000 and 64

A very sophisticated word processing package that allows easy manipulation of text when creating or revising a document. The advanced features include horizontal scrolling of documents up to 126 columns wide, column manipulation for ease of moving, copying, replacing and adding or subtracting columns of data, alpha-numeric sorting with up to 16 levels of sub-division of the sort, high level printer support with a user definable printer feature selection facility for non-standard printers.

'8000'	£149.00
'4000'	£129.00
'64'	£ 86.00

SPELLPRO
— spelling program for 8000 Paper Clip and WordPro

An easy to use spelling checking program that links with the **Paper Clip** and Wordpro wordprocessing package. **SpellPro** allows the user to compare an existing file of text against a standard dictionary that can be extended up to 80,000 words. Any incorrectly spelt words or new words can be displayed on the screen and the user has the opportunity to over-ride the mis-spelling or in the case of a new word, add it to the dictionary. **SpellPro** allows for the whole dictionary to be printed as well as a complete list of any additions or deletions.

'8000'	£149.00

MAILPRO
— data base, mailing program for 8000 Paper Clip and WordPro

An easy to learn data base specifically designed for use in conjunction with a wordprocessing package, such as **Paper Clip** or WordPro. **MailPro** allows for manual input of data via the screen as well as automatic data input from a sequential file, as created by **Paper Clip. MailPro** also has the facility to produce sophisticated reports with multi-level headings and automatic page numbering. **MailPro** will allow up to 4000 records per disk.

'8000'	£149.00

FORTH
— for 8000, 64 and Vic

A powerful operating system and programming language **Forth** is a flexible way to program and use a computer. **Forth** allows interaction, structured program development and will work in any number base. A Text Editor and Macro Assembler are included with the 8000 and 64 versions. **Forth** has nearly 4000 words which can be written in Assembler. This **Forth** is standard fig-Forth with many extensions, including double precision arithmetic, file handling words (trig. functions and powerful string package and searching also for the Commodore 8000 series version).

'8000'	£179.00
'64'	£ 33.00
'Vic'	£ 33.00

PAL 64
— Personal Assembly Language for the 64

Pal 64 is the first truly sophisticated machine language assembler available for the Commodore 64 and includes a machine code monitor. Written by Brad Templeton, **Pal** takes only 4K bytes. In this way the **Pal** can reside in the machine so that it fits into the BASIC environment the PET owners know so well. Features include pseudo codes and labels, mnemonics, decimal and hexadecimal entering.

'64'	£69.00

POWER 64
— programmers aid for the 64

Power 64 is for the adventurous programmer. A series of programming aid tools in the same style as **Power** for the 4000 and 8000 series machines, but with extra features to make use of the full power of the Commodore 64!

'64'	£69.00

REL
— control relay for Vic and 64

Light up with **Rel. Rel** is a control relay that plugs straight into the user port to give simple, programmable switching of electrical apparatus in the home, office or factory. Its six relay outputs can control devices and two inputs allow the Vic to read signals from external sources. **Rel** eliminates black boxes full of wires and represents one of the most exciting value-for-money, firmware additions to any Vic or 64 computer system.

'64'	£30.00

SWITCH
— disk sharing system for the Vic, 64 and PET

The **Switch** will allow up to 8 Vic 20's or 64's and up to 15 PET's to use the same disk drive. This allows you to set up a multi-PET, multi-64 and multi-Vic system with all the units connected sharing the capacity of the disk drive; thus allowing true 'distributed' processing to occur at a fraction of the normal cost. The **Switch** will also allow for multiple disk configurations as well, and is complete with 'site active' indicator.

'8000' Controller	£150.00
Daughter Units	£ 98.00
'64' and 'Vic' Controller	£ 85.00

STAT
— a statistical calculation package for Vic and 64

Crunch and display with **Stat**. A plug in cartridge that undertakes statistical calculations — such as Meanvalues, Standard deviations and Variances — and displays using single commands. Other one word commands allow you to draw vertical and horizontal bar charts, to plot graphs, and to specify the scales and the colours used by these commands. It will also sort numeric and character strings. Finally, all or part of screen displays can be copied to the Vic printer. **Stat** comes complete with a detailed operating guide.

'64'	£33.00
Vic	£25.00

GRAF
— plotting package for the Vic

Plot away with **Graf**. This cartridge allows you to explore the complicated equations and functions of graphs. The menu screen activated by the Vic's special function keys, will automatically plot a graph, define new functions, calculate accurate values of an intersection, find the maxima and minima of a function. Simple editing allows you to check current functions and to change them.

'Vic'	£25.00

All products available from Kobra or from the nationwide Commodore dealer network. All prices exclude VAT.

Company: Kobra Micro Marketing
Address: PO Box 28, Henley-on-Thames, Oxon RG9 1PF.
Tel: Henley-on-Thames (04912) 2512

Time savers

Audiogenic have introduced two programs to save time and money in what they call the 'home office'. The Vicpro is a word processing program designed by the Navoho Software Company. The Vicdata database program has a retrieval speed of just under one second. Both are for use with the VIC-20, the output being obtained on a VIC printer, and can be used together. 8K expansion is required to give enough memory for the creation of large files, which can be dumped onto tape or disc.

They both come on tape and are sold as a package at £12.95.

Area: *Database and word processing.*
Company: *Audiogenic.*
Address: *PO Box 88, Reading, Berks.*
Tel: *0734-586334.*

Sheet feeder for printers

Easifeed is a single bin sheet feeder designed to clip onto numerous printers, including the Diablo 630, Daisy M45/M50 and Qume Sprint 3/5/7/9. It has a reverse print facility which can be operated after the first 20 lines of text.

The unit, which accommodates a range of paper sizes up to 17¾in wide, also has an adjustable paper tray which holds up to 150 sheets depending on the weight of the paper. The price of £595 includes delivery and installation but not VAT. An acoustic hood which reduces noise by 80 per cent costs another £300, but there is a discount for customers who buy both items.

Area: *Printer accessories.*
Company: *WBM Business Supplies Ltd.*
Address: *WBM House, Hipley Street, Old Woking, Surrey GU22 9LQ.*
Tel: *04862-66444.*

Supernews version for the 64

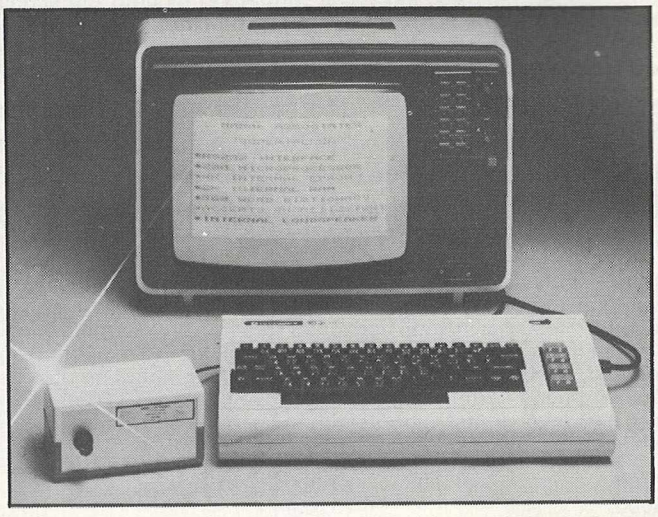
More good news from The Computer Room concerning their newsagents' package, Supernews. Previously designed to be used only on the VIC-20 with a 16K expansion, the package is now available for the 64 at a price of £1,498, excluding the television but including all the software. It is a delivery and account system for use either on the counter or in the back of the shop.

Supernews will cover 10 operations including rounds lists, accounts and debtors' listings. The rounds list alone saves a great deal of time. The system uses an Epsom printer, 64 floppy disc drive, Commodore cassette deck for back-up facility and a stack interface, which are all included in the price. Each disc holds 600 deliveries and any number of discs can be used.

Customers have the option of a lease-buy method of payment at £8.50 a week.

Area: *Newsagents.*
Company: *The Computer Room.*
Address: *87 High Street, Tonbridge, Kent.*
Tel: *0732-355962.*

Namal synthesizer



Namal Associates (Gatehouse, 25 Gwydir Street, Cambridge CB1 2LG, tel 0223-355404), have introduced the Supertalker speech synthesizer for the VIC-20 and all other Commodores that employ an RS232 interface. Based on the phonetic speech synthesizer made by Votrax of Detroit, USA, the unit comes with a standard dictionary of 560 commonly used words which are stored in EPROM, but the user can extend the vocabulary by making use of the 2K static RAM.

500 characters can be held in the input buffer at any one time and there is a choice of 16 standard baud rates from 75—9600. Applications include prompting in games, teaching programs and word processing.

Printer interface

The Universal Printer Interface (UPI) has been designed by Taylor-Wilson Systems to simplify the connection to computers which have IEEE-488 interfaces. Output comes from RS232C and Centronics which are selected by front panel switches and the data rate can be restricted to 100 characters per second.

If both outputs are used at the same time the speed of output will be determined by the speed of the slower machine. If required, the UPI can be set

PET/CBM

CalcResult

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Professional spread sheet at a breakthrough price.

Spread sheet programs have been available for a number of years. The knowledge and experience gained through the use of these led to a demand for a tool that is easier to use, easier to understand and more powerful than contemporaries. The result is Calc Result — a powerful yet low cost '3D' spread sheet for the Commodore 8000 and 64.

* 3D format
* Up to 32 pages
* Horizontal and vertical page split
* Window facilities
* Powerful editing facilities
* "What if . . . "
* "if . . . then . . . else"
* Full graphics output
* Miserly use of memory
* 'Help' functions

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Calc Result
CBM 8000 £149.00
CBM 64 £99.00
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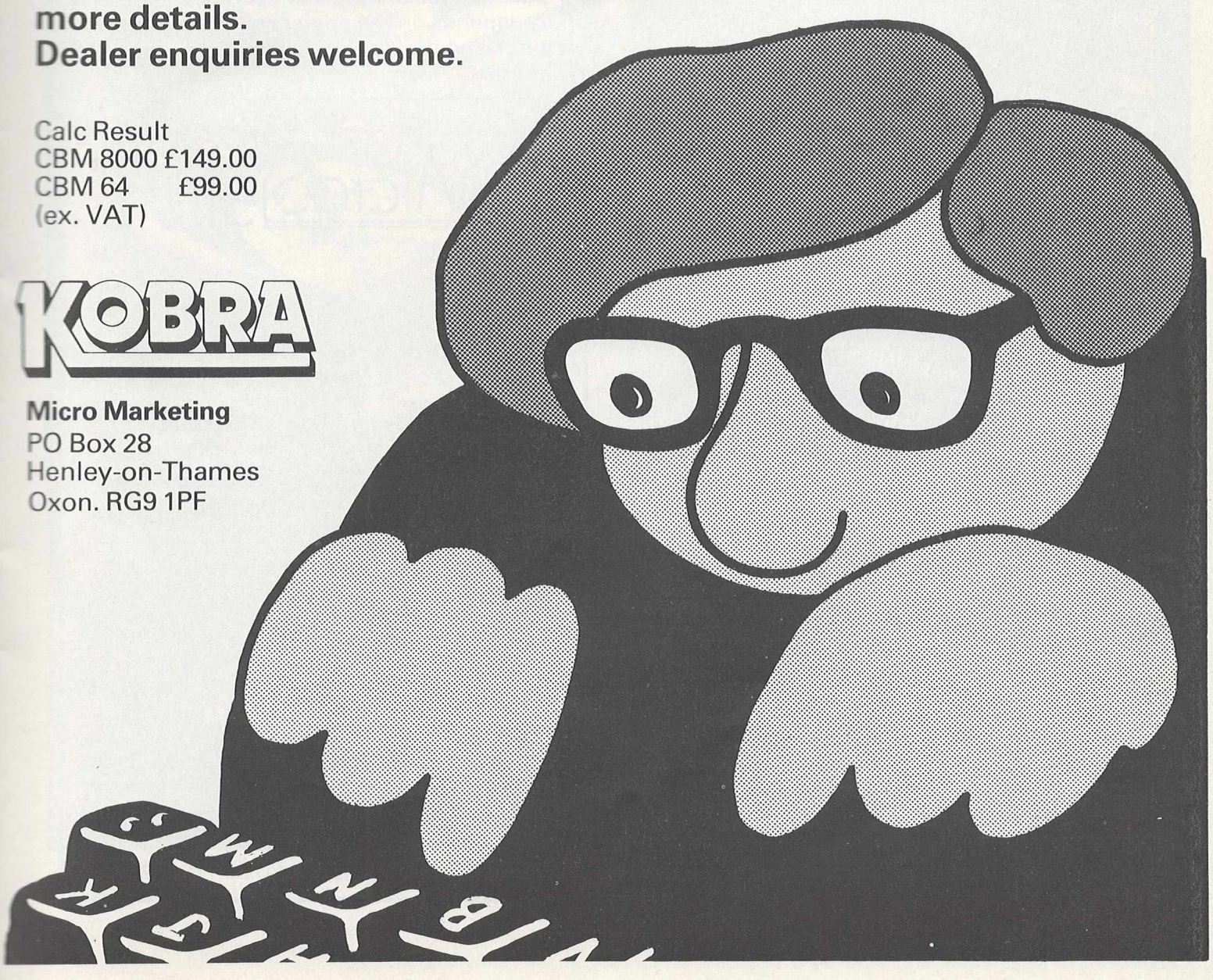

to convert PET codes to ASCII. The interface costs £165, with discounts for orders of 20 or more units. A current loop adaptor is available for £25, but you should specify whether the interface is to be passive or active. There is a warranty of 90 days repair or exchange.

Area: *Interfaces.*
Company: *Taylor-Wilson Systems.*
Address: *Station Road, Dorridge, Solihull, West Midlands B93 8HQ.*
Tel: *05645-6192.*

Reserve power pack

For computer users who want to guard against power failure, Eccleston Electronics (8 Legge Lane, Birmingham B1 3LG), have developed the Battpower unit, which fits in between the mains and the computer. The pack consists of two 12 volt sealed batteries giving a minimum input of 205 volts and a maximum of 270.

If a power failure occurs at the mains, the battery pack immediately takes over. The period of supply depends on the power consumption of the computer and its ancillaries and could be only a few hours.

from small systems.....

PET HARD DISKS

HARDBOX/CORVUS

The Small Systems HARDBOX acts as an intelligent controller for up to 4 Corvus Winchester drives.
- PET DOS 1 and 2 compatibility
- Multi user capability on Corvus Drives
- 16 Megabyte max file size
- 65535 max records per relative file
- Over 2000 files on 5 MB drive

Price £495

MINI-WINI

The MW-1000 Mini-Winchester is a compact desk-top unit that just plugs into the PET – gives you up to 12 Mb of hard disk storage under CP/M or PET DOS or both!!

At the flick of a switch, this amazing unit allows you to have:-
- The whole disk under CP/M (plus 60K of RAM and Z80)
- The whole disk under PET DOS
- Half of the disk under PET DOS and half under CP/M!!

No changes to the PET or ROMS are required – just plug in and go.

3Mb £2538
6Mb £2837
12Mb £3360

Prices include CP/M Utilities, 60K RAM and Z80.

PET CP/M new low prices!!

SOFTBOX and CP/M SOFTWARE

SOFTBOX allows the PET to run the worlds most popular operating system for micros. Operates with PET floppies and/or a Hard disk system.

Comprehensive range of CP/M software available – ask for our Catalogue.

Softbox (with RS232 · Hard disk interfaces as standard) £495

IEEE-488

IEEE-488 SERIAL INTERFACE TYPE C100 ..... £120
IEEE-488 SERIAL INTERFACE TYPE B300 ..... £186
40 char input buffer
IEEE-488 ADDRESSABLE PARALLEL INTERFACE TYPE A100 ..... £106
TYPE G.P.I. AP MICROPROCESSOR BASED IEEE-488 BI DIRECTIONAL INTERFACE £275
1K input buffer standard 59K max.
TV/VIDEO MONITOR INTERFACES £46
RS 232C TO 20mA CURRENT LOOP ADAPTER £17.50

PETSPEED

Optimising Basic Compiler £240

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8048 family in circuit emulator £550
8748 programmer £395
Range of cross assemblers for most popular micros. £95

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Digithurst Ltd.
Leaden Hill, Orwell, Royston, Herts. SG8 5QH
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commodore COMPUTER

PET PACK

BRING TO YOU, NOW ON CASSETTE AND DISK GAMES OF THRILLS & SKILL FOR ALL THE FAMILY

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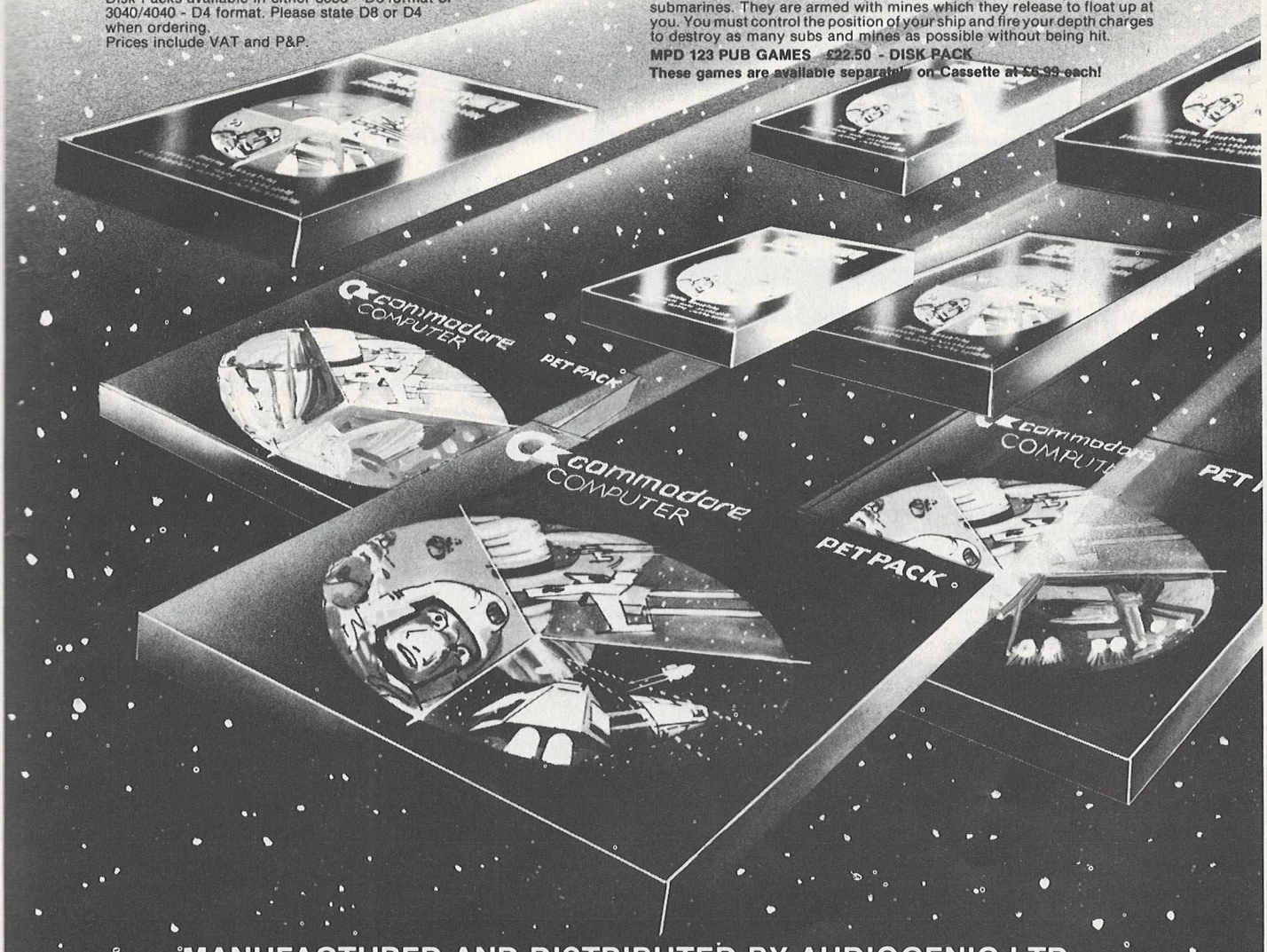

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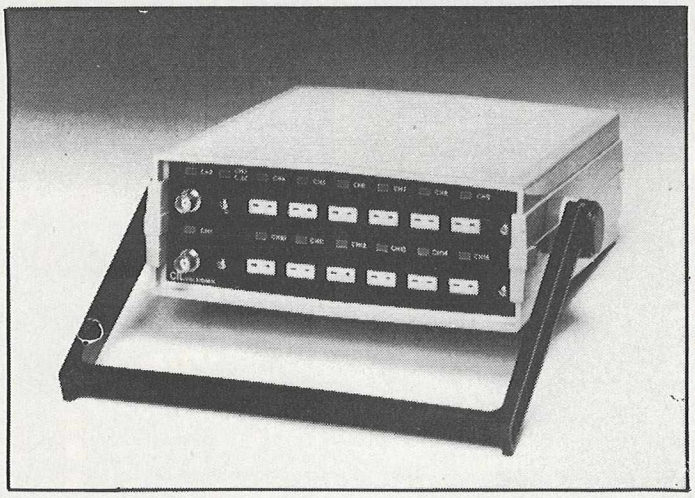

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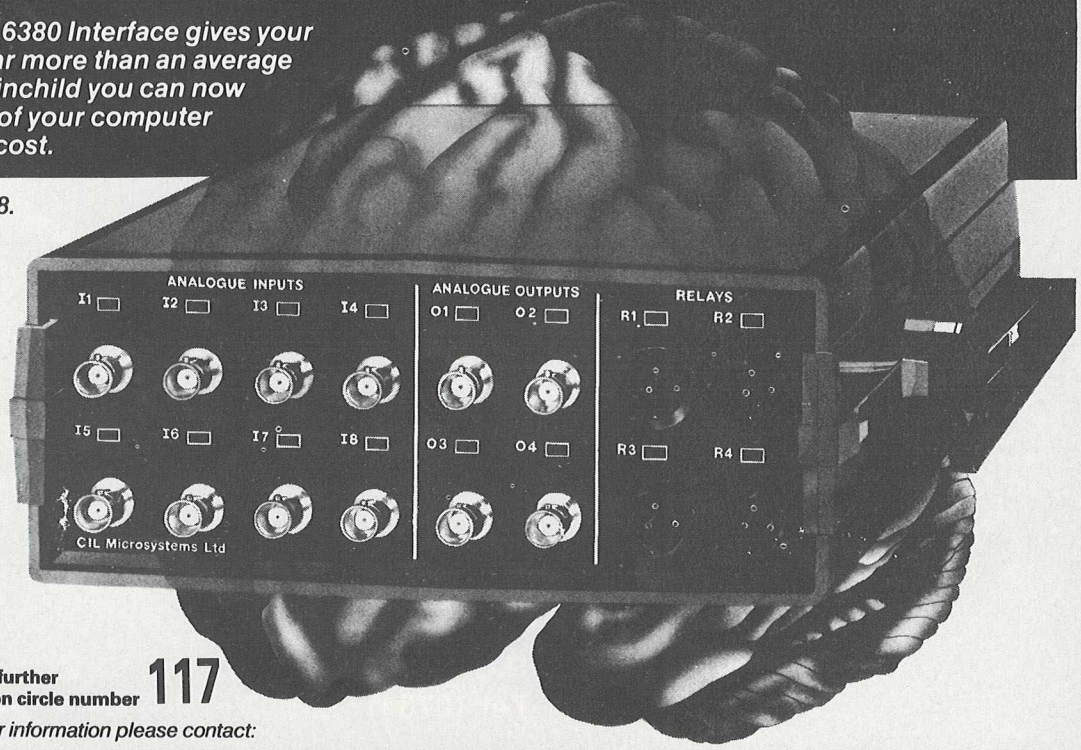

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Graphics pack for easy plotting

You all know what an 8032 is, and in our August 1982 issue we reviewed the two pen Hewlett-Packard graph plotter, the HP-7470A. Our software review this month concentrates on a package that connects the two together and gives you a straightforward way of driving the 7470A, namely the Sumlock Bondain Graphics Pack.

Purpose

Why write such a package at all? After all, the plotter does come complete with its own commands for plotting, scaling and so on. However, using these is not the easiest of tasks, and becoming familiar with them is rather like trying to learn the highway code: you can do it, but it takes time.

Time, as we know, is money, and the people who would be most likely to use the plotter don't usually have the time to spare to sit down and learn everything.

Thus the need arises for a utility package that makes for easy driving of the plotter, and moreover a package that will meet the needs of most, if not all, professional applications.

Thus the need arises for a utility package that makes for easy driving of the plotter.

Background

This suite of programs is living proof of the old adage that 'anyone can learn to program'. No disrespect is intended towards the author, Mike Smith, and indeed a fair amount of praise must go his way. This was his first programming effort, and until a year ago he had never written any code in his life.

Arriving at Sumlock Bondain (one of the first Commodore dealers in this country) from a training course and a stint in a factory, the first job he was given was to 'write a package to use this plotter'. Graduating along the way from Basic into machine code, the result is an elegant collection of programs.

First impressions

We have one disk and one manual. Refreshingly, the manual does not come resplendent in the sort of lurid cover we expect for Commodore products. The only graphics you will see are examples of the kind of output that you can produce for yourself.

Another factor in the manual's favour is that it does not try to emulate *War and Peace* (I suppose if that trend were taken to its logical conclusion you would end up with portable computers that were truly portable except for one thing: the documentation needed to explain how to operate them) but is content to tell you what the package does and how it does it, but no more. The newcomer to Computerworld will not feel lost.

As long as you know how to press SHIFT and RUN/STOP you'll have no problems getting started, and from then on you're in a world of menu-driven programs that are easy to follow and operate.

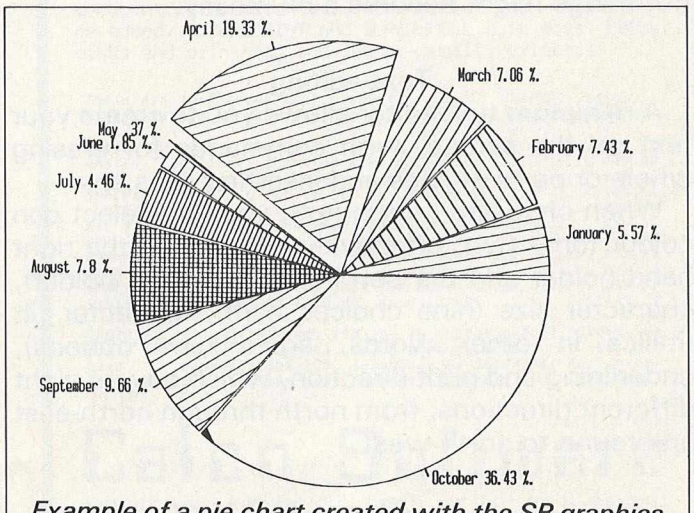
From the main menu you have a choice of four drawing options: pie charts, line/bar charts, a drawing program and a text editing and printing program. Let's look at each one in turn.

Pie charts

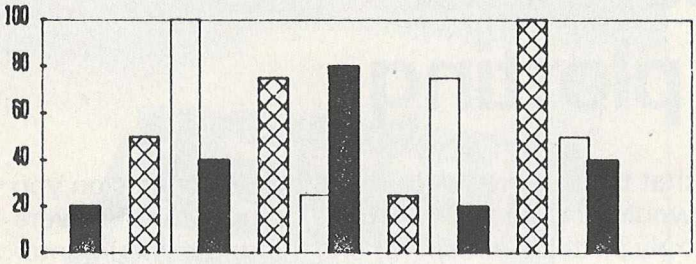
Having selected the option we enter 'create chart' mode, which allows all the relevant data to be entered. Titles, number of segments, percentage values, how you want it shaded in, whether you want it exploded (to make one segment stand out, to highlight a particular point, for instance), what colour pen you want used at any time, and so on.

Having entered all the data to our satisfaction, we can move on to another menu, called the utility menu, which allows us to save a copy of the details onto disk for later use, or we can edit it further, print it out, or (horror of horrors) erase the masterpiece you've just created.

Plotting of the chart can be done in any one of seven positions, from using the whole A4 sheet of



Example of a pie chart created with the SB graphics pack.



Section of a histogram created with the SB graphics pack. Up to six sets of data can be compared in the same chart.

paper on the plotter, to the top half, the bottom right hand corner, and so on. All scaling is automatically done, and your option is chosen simply by pressing the relevant numeric key on the top row of numbers; not the separate numeric pad.

Taking advantage of some of the features of the plotter, pressing STOP allows you to interrupt the plot, to see how it's going, change pens or whatever, and then carry on as if nothing happened; or you can abandon a plot altogether.

You have eight different types of shading options available to you, and six different colour codes. It's interesting to watch the plotter when pens require changing, as it performs all the plotting it can with one colour before requesting you to change the pen yourself for a different colour. Alas, it's not intelligent enough to do that itself!

Line bar charts

Everything follows much the same sequence as above, with editing, saving, creating etc. of each chart made very straightforward. Up to six sets of data can be compared on the same chart, as you have six different types of line drawing to choose from. With six different colours as well, I suppose you could compare up to 36 sets of information, but things might become a bit messy.

Text editing

A miniature text editor allows you to create your text on the screen, with commands for erasing whole or parts of lines and inserting lines.

When choosing your output you can select pen colour (only two, effectively: the pen in the right hand holder and the pen in the left hand holder), character size (nine choices here), character tilt (italics in other words, again nine options), underlining and print direction, which covers eight different directions, from north through north-east and round to north-west.

Drawing option

Probably the most interesting one of all. Entering the 'create chart' mode will give you a new menu called the Control Menu.

The Digitize option works as you might expect. Moving the pen to the correct position by using the keys on the plotter and pressing RETURN (make sure you know when the pen is supposed to be up and when it's supposed to be down) enters the co-ordinates into the 8032. Thus fairly complicated drawings (circuit diagrams, company logos, letterheads etc.) could be drawn and stored for later use.

The two modes for rectangles and polygons allow extremely accurate shapes to be drawn with the minimum of operator involvement. Scaling can be done on anything plotted from this drawing option, with drawings either being enlarged or reduced in any direction as appropriate.

Any, or all, of these options can be used in conjunction, simply by not removing the paper from the plotter after a plot has been completed. A look at some of the examples given here should give you a reasonable idea of what can be done.

Another factor in the manual's favour is that it does not try to emulate War and Peace.

Conclusion

The reviewer, by no means a draughtsman or designer, was able to produce complicated charts and reports within half an hour of sitting down at the keyboard, so the package is obviously easy to use.

My only complaint, after using the system for some time, concerns the manual itself. It took me about 15 minutes (some people will take less time, others probably longer) to find out how to save a design for later use. A power failure in that time would have meant one annoyed reviewer!

Link-ups to multiple plotters can easily be done, if you want to hear three HP 7470As chattering away to each other. Given 100 plotters randomly plotting away, how long would it take before they designed the GPO Tower?

An extremely useful package. The program does precisely what it sets out to do, making plotting a simple exercise. It should find many applications.

Program	*: Sumlock Bondain Graphics Pack.*
Price	*: £350.*
Configuration	*: 8032/HP7470A/disk drive.*
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PM 96

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Turning pictures into screen images

Seeing is believing. In the case of Microsight, produced by Digithurst Ltd, seeing is also learning. MicroSight is a CCTV-based system that employs a MicroEye camera interface to digitise captured images and pass the image to a microcomputer via a standard 8 bit parallel port.

Any microcomputer can be used as long as it has a Supersoft high-resolution graphics board to go with it, although when I first tested the system it rejected the keyboard of the 8032 and would only co-operate in conjunction with a 3032.

Any make of camera can be used as long as it can output video or UHF. The camera reads in data from the MicroEye interface and places it in the microcomputer's RAM. Any unprocessed image on which the camera focusses is interpreted by the software as a series of horizontal scans and the end of the image is denominated by an end of line marker.

The image is converted into vertical columns of digits by the MicroEye interface and the columns are read into the micro's RAM in such a way as to appear in an acceptable format when read by the image processing routines.

If a column count is set to 60 instead of 128, an image can be built up out of 60 × 128 pixels in less than a second.

The camera does not process frames or store images. With the help of the software and a section of the microcomputer's RAM the frame can be stored while the image processing is carried out.

256 × 256 pixels originate from the camera interface although because the camera misses every other pixel and ignores every other column of data, the camera routine uses only 128 × 128 pixels. It is possible, however, for this routine to be modified so that smaller windows can lay on the original image. Thus, if a column count is set to 60 instead of 128, an image can be built up out of 60 × 128 pixels in less than a second. It is also possible for windows to overlap windows, the digitised video being available on eight output lines.

Data is held in either a processed or unprocessed form and remains unprocessed until it encounters the 'chain' routine which produces from the runs of data 3 byte representations of runs of a particular colour, a run consisting of 134 bytes. As the data is being compacted, the pixels are thresholded—that is, categorised—and grouped into two colours, either black or white according to the darkness of the original image.

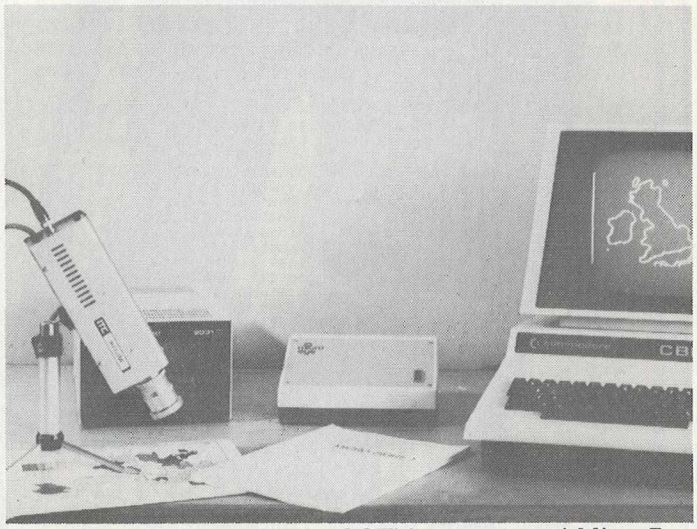
Any unprocessed data is held in the microcomputer's memory as 128 rows of 129 elements, the latter including the end of line pulse. If all eight lines of output are to be utilised then the bytes which make up the pixels are given a value from 0 to 225. Processed data is stored as run length encoded data, which is a compact method of holding frames while analysis is carried out to determine such characteristics as area, perimeter length and centre of gravity.

Words and letters

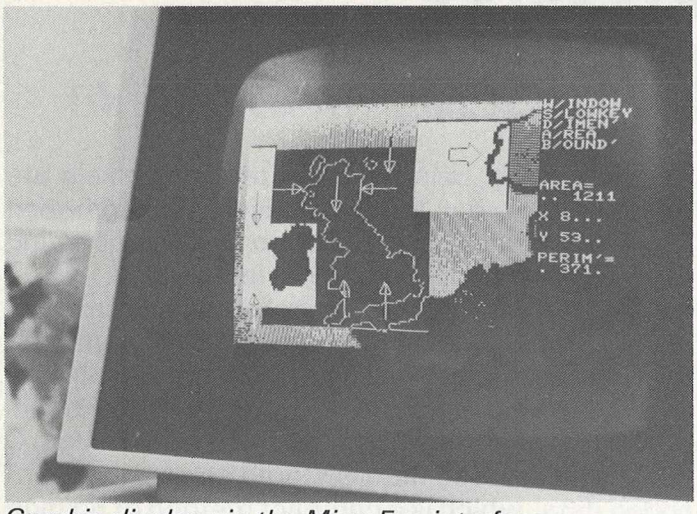
The system is designed for use with a single disc drive. It will process not only pictures but words and letters as well. The information can either be stored on a disc or dumped out on a printer, the latter operation depending on the routine of the printer.

Among the MicroSight's functions, there is a command processer (Vid 1) which acts as a calling routine for six machine code programs that absorb the data from the camera interface and display it on the screen. Along with this come two disk routines; Disk transfers facsimile data between the screen memory and the disk, while Disk 2 carries the processed image between disk and RAM.

Having loaded and run Vid 1, the first of two menus dislays a set of commands to manipulate data, i.e. displaying the picture, setting the



The MicroSight package: CCTV camera and MicroEye interface



Graphic display via the MicroEye interface

threshold and colour, storing and loading images and processing images. Pressing P for processing also gives access to the second menu, which allows you to set further routines in motion, like setting boundaries and displaying the processed image.

The boundary of any shape is easily detected because the whole image is scanned. The difference between high and low threshold areas denotes a boundary between black and white and is a good illustration of the uses to which the processed data can be put. The facsimile data is called up using a routine called FACIMOL in which each camera element is given the value of four screen pixels so that five levels of grey can be picked out to describe the image.

This function uses the Flag, Flag1 and X and Y point variables of the graphics board in the Commodore PET and is similar to FACIM 1, except that the latter operation replaces a complex plotting routine with a jump to a sub-routine. The function of FACIM 1 is to display a thresholded image from unprocessed data. Also very similar is the binary display DISP, which displays a thresholded image after the data has been processed.

The complete MicroSight system costs £495 plus VAT and the MicroScale package is available for £295 plus VAT.

Area:	*Image processing.*
Company:	*Digithurst Ltd.*
Address:	*Leaden Hill, Orwell, Royston, Herts SG8 5QH.*
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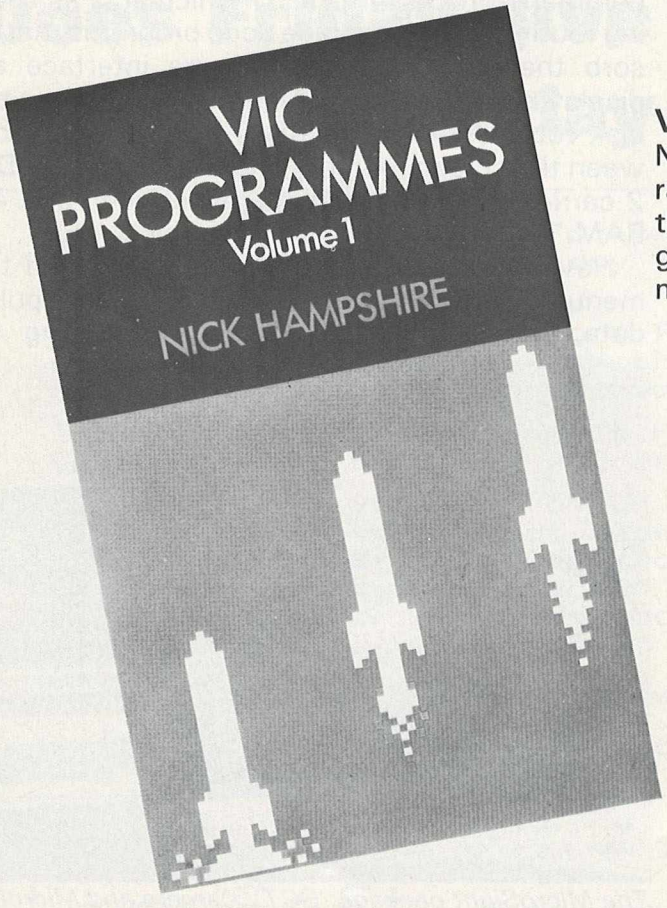

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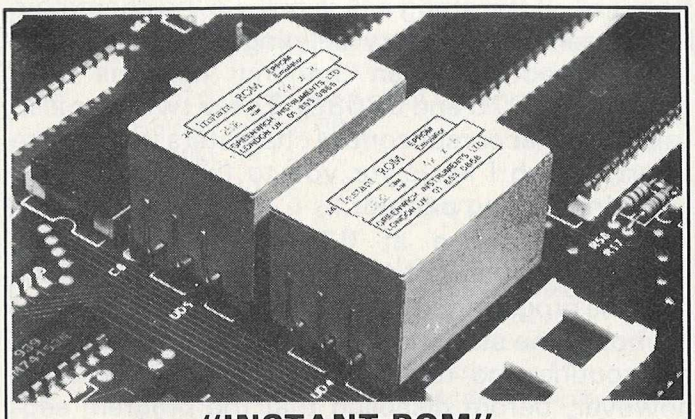

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Input and get on the PET

D. Milnes

These programs prevent 'dropping out' and can be used as sub-routines within a main program.

I was browsing through some of my old programs written when I bought my first 3000 series 16K PET when I realised there must be a number of new users of the PET who tend to be forgotten by the veteran users who write into their programs routines which to them come as second nature.

These are relatively complicated routines or tricks of programming which are not known to the newcomer. The following four program segments are concerned with 'input' and 'get' on the PET and can be used effectively as sub-routines within a main program.

Many computer users criticise the PET for the annoying quirk of dropping out of a program when 'return' is pressed on input request, thus entering a null input. The four routines which I have outlined demonstrate different techniques for preventing this and also give the programmer control over what is typed in by the user of the program. Before we look at them, try the following:

```
10 input a
```

'Run' the program and then press 'return' without pressing any other key. The 'ready' message will appear — you have dropped out of the program. Now type 'cont' (i.e. continue) and you will be presented with the question mark input prompt, allowing you to enter the value which the program requires.

So if you ever press return too soon, typing 'cont' will enable you to continue with the program at the place where return was pressed.

```
 1 rem *** using 'get' to accept one key press
 2 rem ***
 3 rem *** "D.Milnes ----- Jan 1983
 4 ::::
 100 print"Accept data .....  y/n":gosub62000
 39998 :::::
 39999 end
 61999 :::::
 62000 geta$:ifa$=""then62000
 62010 ifa$<>"y"anda$<>"n"then62000
 62020 return
 62030 :::::
 63999 scratch"get key":dsave"get key"
ready.
```

Program 1

Program 1 is for accepting a key press as continuation of the program. The sub-routine at 62000 trapping anything other than 'y' or 'n'. Any other key press can be accepted by adding them to 62010.

Program 2 is a little more complicated but still understandable if you take it one step at a time. The GET command is again used and in addition provides a simulated flashing cursor — 62000 to 62020.

The cursor control keys (up, down, left, right, home, delete and clear screen) can be tested for and trapped and also used to control the input from the keyboard (e.g. line 62040 clears the string az$ to null if clear home is pressed).

Deletes the character

Line number 62050 deletes the last character typed in if the delete key is pressed and then goes to the sub-routine 62500 to strip the last character from az$. If the string az$ is null, i.e. no characters have been typed in (try deleting before typing in any characters) then nothing happens (line numbers 62070 and 62080). These two lines also trap the other cursor control characters (apart from insert, which I leave for you to fix) and prevent them from being printed.

The sub-routine at 63000 initialises string variables, e.g. chr$(147) = clear screen. To make sure the programmer has complete control over the keyboard the stop key can be disabled on entering the routine and re-enabled on exit. Make sure, however, before disabling that the program segment is working or you may find yourself locked up and that can be frustrating, to put it mildly.

Dropping out

Programs 3 and 4 use the input command. The first opens the keyboard as a file 4 (the keyboard is device number 0, the screen device number 3). When in input mode a null return will not be accepted and the stop key will not work. One way of dropping out of the program is to press 'shift return' followed by 'return'. Line number 120 stops this unlikely event happening.

Program 4 produces a character under the flashing cursor. Thus if 'return' is pressed without

D. Milnes, a chartered engineer, lectures to engineering students at Dewsbury and Batley Technical and Art College. He also teaches computer programming.

Program 2

```
1 rem *** using 'get' to accept more than one key press
2 rem ***
3 rem *** "D.Milnes ----- Jan 1983
4 ::::
10 goto63000
100 gosub62000
999 end
61998 ::::rem false cursor routine
61999 ::::
62000 az$="":poke144,88::rem disable stop key if req'd
62010 printzy$;:foriz=1to150:next:printzx$;:foriz=1to150:next
62020 getz$:ifz$=""then62010
62030 zz=asc(z$)
62040 ifz$=cl$thenforiz=1tolen(az$):printde$;:next:az$="":goto62110
62050 ifz$=de$andlen(az$)>0thenprintle$zx$;:gosub62500:goto62010
62060 ifz$=cr$then62110
62070 if(zz>16andzz<21)or(zz>144andzz<148)then62010
62080 ifzz=157orzz=29then62010
62090 az$=az$+z$:printz$;:goto62010
62100 goto63010
62110 poke144,85:return:::re-enable stop key on return
62199 ::::
62498 ::::rem delete last character
62499 ::::
62500 az$=left$(az$,len(az$)-1):return
62599 ::::
62998 ::::rem initialisation routine
62999 ::::
63000 ho$=chr$(19):cl$=chr$(147):do$=chr$(17):up$=chr$(145):le$=chr$(157)
63010 ri$=chr$(29):r0$=chr$(146):r1$=chr$(18):de$=chr$(20)
63020 cr$=chr$(13):zy$=r1$+chr$(42)+r0$+le$:zx$=chr$(32)+le$
63040 goto100
63100 ::::
63110 ::::
63118 ::::rem control characters to use or reject
63119 ::::
63120 ::::ho$ = home cursor
63130 ::::cl$ = clear screen
63140 ::::do$ = cursor down
63150 ::::up$ = cursor up
63160 ::::le$ = cursor left
63170 ::::ri$ = cursor right
63180 ::::r0$ = reverse off
63190 ::::r1$ = reverse on
63200 ::::de$ = delete key
63210 ::::cr$ = return key
63220 ::::chr$(42) = 'star' ... used as prompt
63230 :::::
63240 :::::
63997 :::::lazy scratch and save
63998 :::::
63999 scratch"false cursor":dsave"false cursor"
ready.
```

entering characters the character under the cursor is accepted as the input and this can be trapped quite easily and can be used as a control to take the operator back to the main menu as an example.

The fifth program sub-routine is a lazy way of saving a program to disk or listing to printer or even displaying the contents of important data files.

Usually a menu of options is my starting point of any program development, one of the options being to terminate the program. This terminates option jumps to the menu as listed. Then by one key press I can save the current version of the program to disk or list it to printer etc.

Finally I have enclosed an updated version of the Basic screen dump to printer which appeared in the now obsolete CPUCN. It will work on all versions of the PET — slow but easy to use.

It can be appended to any program and at any time a screen dump is required. Our students use it for project assessment purposes where utilities can be used but have to be listed with their project. Pressing 'd' or any other appropriate symbol will dump the screen to printer and then continue with the program.

Program 3

```
 1 rem *** using keyboard as an open file to accept input
 2 rem ***
 3 rem *** "D.Milnes ----- Jan 1983
 4 ::::
 100 open1,0:::rem open keyboard ( file zero ) as a file
 110 print"Type in name     ";:input#1,n$
 120 ifasc(n$+chr$(0))=0then110 ::: traps 'shift return' pressed first
 130 ::::
 140 rem .. delete line 120 and run
 150 rem .. on prompt press 'shift return'
 160 rem .. followed  by a normal 'return'
 39999 end
 63998 :::::
 63999 scratch"input key":dsave"input key"
ready.
```

Program 4

```
 1 rem *** using 'input' with character under flashing cursor
 2 rem ***
 3 rem *** "D.Milnes ----- Jan 1983
 4 ::::
 100 q$=chr$(46)+chr$(157)+chr$(157)+chr$(157)
 110 print"Type in name     ";q$;:input n$
 120 ifn$=chr$(46)then110:::traps 'return' with no input
 130 ::::
 39999 end
 63998 :::::
 63999 scratch"key input":dsave"key input"
ready.
```

Lazy save and listing

```
 63500 print"1. listing
 63501 print"2. save on disk
 63502 print"3. view file
 63503 print"4. close printer
 63504 print"5. terminate
 63505 geta$:ifa$=""then63505
 63506 :
 63507 :
```

```
 63510 onval(a$)goto63600,63630,63660,63650,63640
 63520 goto63500
 63530 :
 63600 :: open7,4,7:print#7:close7
 63610 :: open4,4:cmd4:print#4,chr$(147)chr$(1)"DISK DIRECTORY"
 63620 :: print#4:print#4,"(c) D.Milnes ....... "da$:cmd4:list
 63630 :: scratch"diskdirectory":dsave"diskdirectory":goto63500
 63640 :: open15,8,15:print#15,"i0":close15:end
 63650 :: print#4:close4:goto63500
 63660 :: dopen#6,"..summary..":foraa=1to140:input#6,sc$:printsc$
 63670 :: ifst=0thennext
 63680 :: dclose#6:goto63500
 63690 :
 63900 :::::---------------::::::
 63910 :::::"D.Milnes"
 63920 :::::"13 Delmont Close"
 63930 :::::"Whitelee Rd"
 63940 :::::"Batley"
 63950 :::::"West Yorkshire"
 63960 :::::"WF17 8AQ"
 63970 :::::---------------::::::
ready.
```

Screen dump to printer

```
 10 rem your screen display
 20 rem
 30 rem
 40 rem
 50 rem
 60 rem
 70 geta$:ifa$=""then70
 80 ifa$="d"thengosub63000
 90 rem
 100 rem
 9999 end
 63000 printchr$(19):fori1=1to90:printchr$(29);:next:type=peek(216)
 63001 tscr=32768:lscr=34767:t=80:open4,4
 63002 iftype-2thent=40:lscr=33767
 63003 fori1=tscr to lscr:ifpeek(i1)<>32goto63005
 63004 next:print#4,"blank":close4:end
 63005 bz=i1-tscr:bz=i1-(bz-(int(bz/t)*t)):fori1=lscr to tscr step-1
 63006 ifpeek(i1)<>32goto63008
 63007 next
 63008 az=i1:lz$="":ifpeek(59468)=14thenlz$=chr$(17)
 63009 print#4,lz$;:fori1=bztoaz:a=peek(i1):k=k+1
 63010 b=(aand127)or((aand64)*2)or((64-aand32)*2):print#4,chr$(b);
 63011 ifk=tthenprint#4,chr$(13)lz$;:k=0
 63012 next:print#4:close4:return
 63020 ::::
 63030 ::::
 63040 :::: screendump to printer 40/80 column
 63050 :::: line #63000 checks 40 or 80 column
 63060 :::: and resets 't' to line length &
 63070 :::: lscr to 33767 (bottom screen location) for 40 column
 63080 ::::
 63090 :::: d.milnes   january 1983
 63100 ::::
 63999 scratch"screendump":dsave"screendump"
ready.
```

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Finding out the facts

Robert Moscrop

Having identified the project to be investigated and defined its boundaries, the next stage in the systems development cycle is to define the requirements and communicate these in a professional and unambiguous manner to those who have to advise on the solution to the problem, i.e. hardware, application packages or a bespoke system. This requires an understanding of fact-finding and recording techniques.

Before proceeding, the investigator is well advised to spare a thought for the public relations aspect of his task. It may well be the first time he is involved in this area or faces this group of people. Those whose work is under study may never have faced an investigation before, in which case their caution, ignorance of computer technology and fear of job security must not be taken too lightly.

The analyst should try to be objective, logical (adopting a step by step approach), organised, confident, communicative and entrepreneurial (aiming to contribute to profit rather than save expense).

FACT-FINDING

1. Interviewing

This is essentially the art of conversation in which a well thought out and timely question will not only provide the information but hopefully stimulate discussion.

Interviews can be divided into three types:

a) Introductory. To fix the time and venue for the main fact finding interview. This allows the interviewee to prepare and affords an opportunity to establish a rapport if the parties are not acquainted.

b) Fact-finding. This is the most significant part of the investigation and should therefore be the subject of careful planning. In conducting the interview, the analyst should pattern his conduct around the following points:

1. Diplomatic — Avoiding argument, criticism, personalities.
2. Inquisitive.
3. Evaluate — Fact from opinion.
4. Economy — Time, words.
5. Terminology — Avoid jargon, use terms that are used in the application environment.
6. Control — The interviewer should steer the meeting away from argument, irrelevancies and side issues. In the event of serious clashes, consider an adjournment.
7. Conclude — Review facts, agree the next step. As soon as possible after the interview, the facts should be recorded.

c) Follow-up. As the investigation proceeds, it may be necessary to return to clarify points or seek further information. In the absence of a valid reason, as part of the P.R. exercise, good reasons for returning should be invented. The interviewee has given of his time and hopefully had his interest and enthusiasm aroused. This groundwork will be undone if contact is not maintained.

The classical form of an organisation structure indicates a three level approach to an investigation:

a) Management — goals and objectives; policy.
Discuss — new systems concepts; total concept.
b) Line management — work flow.
Determine — departmental functions; concepts.
c) Operations — work flow.
Establish — volumes, bottlenecks.

At an early stage in the investigation, the analyst must modify the foregoing plan in the light of the operating characteristics of the company.

In smaller or more traditional organisations, top management may become involved in line functions. Alternatively line managers may play a greater part in policy and structures.

2. Questionnaires

The use of questionnaires in fact-finding has two main areas of application: to establish trends by statistical sampling techniques, and to obtain information where the density of population or the geographic location would forbid conventional techniques of gathering information.

Having chosen this technique, the first task of the analyst is to determine:

a) What he wants to know.
b) From whom he wants to know.
c) Whether he is soliciting fact or opinion.
d) On what authority the respondents make their reply.

Having defined the problem, it is now possible to

Robert Moscrop, director of Computotech Ltd, is a widely experienced systems analyst and designer. Since 1978 he has been developing training systems for the Manpower Services Commission and working as a consultant.

define the investigation area and design the means of collecting data.

3. Record inspection

This technique is complementary to others and involves checking the opinions gained, in addition to being the source of much quantitative data.

There are three main application areas: to establish trends; confirm and detail facts; and discover exceptional conditions.

Tact must be employed when inspecting records. It should be done openly with the approval and authority of those responsible for the records. Not all records need to be inspected. Statistical sampling techniques can be invaluable.

4. Observation

At all times during a study 'eyes and ears open' is the watchword.

Having found the facts, it is necessary to document them by use of documentation techniques.

Network and data flow analysis is purely a means to an end, a method of recording the problem before examining the situation prior to design.

It may happen, therefore, that these units in network analysis are hypothetical, one unit stretching over a number of departmental, application or functional boundaries. Identification may often appear difficult. It must be remembered that these are only 'name tags' for our convenience.

A unit will be justified by the subjective weighting, the following being examples:

Terms of reference	*Justification of units*
Uplift	Volume of information
Construct	Volume of work done
Reconstruct	Volume of information
Re-organise	Number of people in the operation of the unit

The number of 'levels' in the grid will vary according to the boundaries imposed by the terms of reference:

A DEPARTMENT e.g. costing department — single level grid.
AN APPLICATION AREA e.g. payroll — single level grid.

WAGES	Calculate Labour Costs	Compute Tax	Pay Employees	Maintain Statutory Records

Department

STORES PROCUREMENT	Authorise Factory Indents	Select Supplier and Place Order	Monitor Order Book	Authorise Payment	Maintain Supplier Master

Application

Note that these two may be interactive.

THE TOTAL ORGANISATION — multiple level grid. In this case, the grid, and the resultant data flow diagrams, will reflect the information network of the organisation (See opposite).

In practice, the former two are most likely to be employed in studies done from within the company, whereas the latter is more the approach at consultant level.

Having defined a level, it is advisable to make a record in narrative form of the tasks performed within each unit. For this purpose, a unit identification form should be used to record:

a) The name of the unit.
b) Location of the grid.
c) The objectives of the unit in business terms.
d) The constraints within which the objectives are attained.
e) The time scale within which the operations are performed.

This record can be maintained on a free form layout, although a more formal document is often preferred.

It is emphasised that network grid analysis is nothing more than a technique used by analysts in doing their job. A unit is simply a tag given to a volume of information, work, or people, grouped into levels for the purpose of subsequent study and recording. The unit itself may be a grouping of sub-units or tasks.

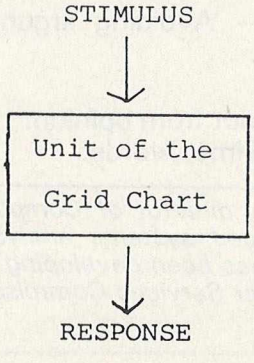
Having identified the grid structure, it is possible to add the information flows.

The concept of an information set is a convenient way of thinking about and recording stages of the investigation.

By the nature of the units of the network structure, the physical processes or elements can easily be broken down into:

a) Doing — the objectives of the units.
b) Movement of information.

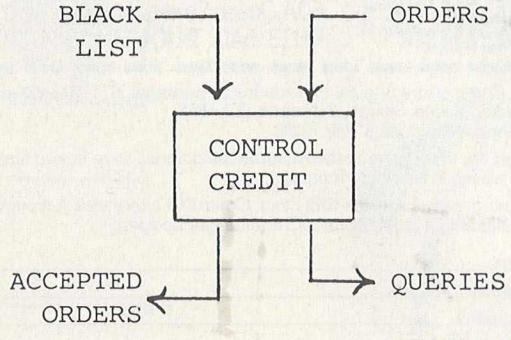
In breaking down the mass of information into logical units, it will be found convenient to think of the sets as stimuli and responses to operations thus:



LEVELS / UNITS	A	B	C	D	E
LEVEL 1 MANAGEMENT	FORMULATE PLANS AND POLICIES	ALLOCATE FINANCIAL RESOURCES	MONITOR SHORT TERM OPERATIONS	MAINTAIN PROFIT AND LIQUIDITY	MAINTAIN CUSTOMER LIASON
LEVEL 2 FINANCE	LEDGERS & BUDGETS	ACCOUNTS RECEIVABLE	ACCOUNTS PAYABLE	LABOUR ACCOUNTS	COST ACCOUNTS
LEVEL 3 PRODUCT PLANNING	PRODUCT SPECIFICATION AND COST	METHOD STUDY	QUALITY CONTROL		
LEVEL 4 PRODUCTION	SCHEDULE LABOUR	SCHEDULE MATERIALS	CONTROL MANUFACTURE	MONITOR PERFORMANCE	
LEVEL 5 MATERIALS	DETERMINE MATERIAL SOURCES	PLACE AND MONITOR ORDERS	INSPECT AND CONTROL QUALITY	CONTROL STOCK LEVELS	

Example of multi-level grid

Because processing has taken place, the information content of the stimulus and response will differ thus:



From the foregoing example it will be noted that the paths of the information sets will differ, hence give the structure of the network.

A typical information set structure in the manufacturing industry is represented in figure 1.

The levels referred to correspond to the levels of the information network.

Once the data flow has been recorded, the final step is that of quantification. For this purpose, a variety of forms exist, the main points to be

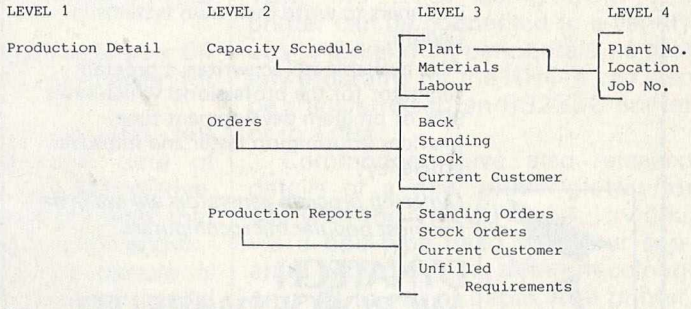


Figure 1

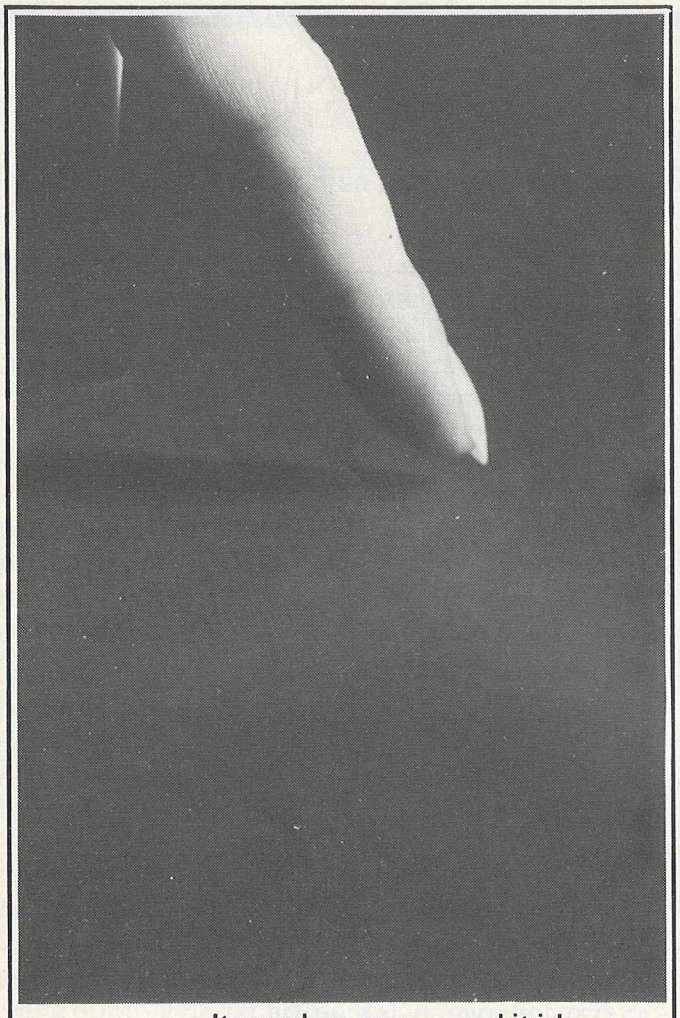
covered being:

a) Information content.
b) Raison d'être.
c) Type or level of information.
d) Volumes — mini/max/average.
— high/low peaks.
— growth factor.

From a critical study of the data flow diagrams and quantification, a solution will evolve.

Next month

Evaluating the proposals and choosing the appropriate hardware and software.



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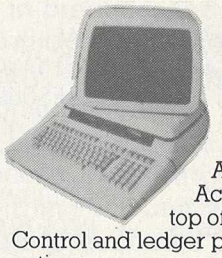

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THE SMALL COMPUTER SUPPLEMENT TO COMMODORE COMPUTING INTERNATIONAL

News

For the 64 and the VIC-20 – a low-cost MicroDrive

If you own a VIC-20 and want a disk drive, you have to be prepared to part with an awful lot of money. If you own a Commodore 64, you have to part with an awful lot of patience as well.

At least, that was the case until early March, when BATS-NCI Ltd announced the most interesting development yet for VIC and 64 owners.

Their three-inch MCD disk drive is priced at £180 for a single disk version, and £275 for the half-megabyte twin disk system. Included in the price is the power supply, interface connector, controller, operating software and instruction manual. In short, everything that you need to get it up and running on your VIC or 64.

MCD disk drive

Additional disks will cost you £4 each, but there are discounts for quantity orders.

Bill Musker of BATS-NCI (01-349 4713) quotes a delivery date of mid-June for the 64 MicroDrive. This, of course, coincides with that annual extravaganza, the PET show.

For VIC-20 users the picture is more rosy, with a working model being on display at the recent VIC and 64 Users Show, and an anticipated delivery date of mid-April.

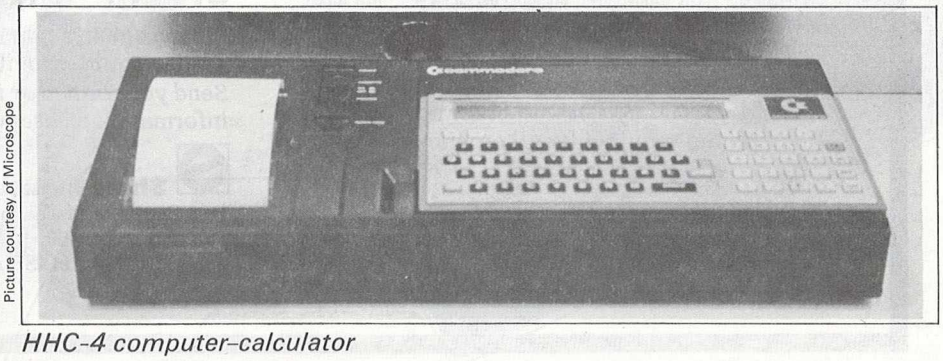
Data transfer rate is a fast 1.2 kilobytes per second, with an average access time comparable to normal mini-floppy drives. To back-up a copy of a full disk takes just 20 seconds! It is also small, with dimensions of just 85 × 115 × 41 millimetres.

With the simple operating commands available, both sequential and random access filing of data are possible. Basic or machine code programs can be stored as normal.

Designed for the hand

New from Commodore is the HHC-4, a hand-held computer/calculator with built-in 24 character LCD display and 2-column printer unit. The RAM can be extended from 4K to 16K, the ROM being 20K. The printer can be connected to a variety of VIC-20 and 64 peripherals, so that any programs for the HHC-4 can also be transferred to an RS232C printer or to a disk.

Commodore have also released details of a new printer/plotter for use with the VIC-20 or 64. It works via a biro-type head with four separate pens providing different colours on a $4\frac{1}{2}$ in roll of paper. The printer, which can step 999 dots vertically and 480 dots horizontally, is expected to retail in the States for $199.95 and should be available in Britain later this year.



Picture courtesy of Microscope

HHC-4 computer-calculator

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NEW

For VIC 20 and CBM 64 Users

SIP ACCOUNTING SYSTEM

Highly comprehensive program designed for 16K, 24K, VIC20 & Printer, 40 col VIC20, CBM 64. Makes an ideal introduction for you and your staff to the world of computer accounts.

S.I.P. ACCOUNTING SYSTEM PRINTOUT DATE 20/02/83

SALES LEDGER ANYCO STATEMENT

INV#	DATE	DEBITS	CREDITS
DISC	20/02/83		00039.01
DRAFT	16/ 2/83		00050.00
4025	15/ 2/83	00062.10	
4009	12/ 1/83	00073.60	
4001	1/ 1/83	00524.40	
	TOTAL BALANCE	£ 00571.09	

Features include:

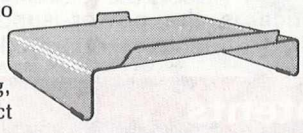
- Menu driven – simplicity to use!
- Up to 250 accounts per tape
- Day book
- Sales and purchase ledger (or just 1 type)
- Statements print (for all or just one company)
- Overdue account statements (as above)
- End period carry on to next data tape
- Cash summary – debitors and creditors
- VAT entry (net or gross)
- PLUS many, many more features – all in ONE program.

Program specification:

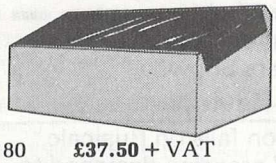
SIP/AC 20 – 16K (approximately 130 invoices per data tape)
SIP/AC 20 – 24K (approximately 350 invoices per data tape)
SIP/AC 40 – 40col + 24K + 3K (approximately 430 invoices per data tape)
SIP/AC 64 – CBM64 (approximately 650 invoices per data tape)
Note: printer required for all programs.

TAPE PLUS MANUAL £24.95 + VAT

Optional Extras:



Printer plinths – designed to save space, improve paper flow, and tidy stray cables, has anti-vibration mounting, superb design in high impact smoked Perspex.
SIP/P1515 for VC 1515 and GP 80 **£17.95** + VAT
SIP/P1525 for VC 1525 and GP 100 **£18.95** + VAT



Acoustic covers – reduces noise levels dramatically, smartly styled.
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SPECIAL OFFER! GP 100 VC Printer PLUS SIP accounting program. **ONLY £245** + VAT + £10 Post and Pack.

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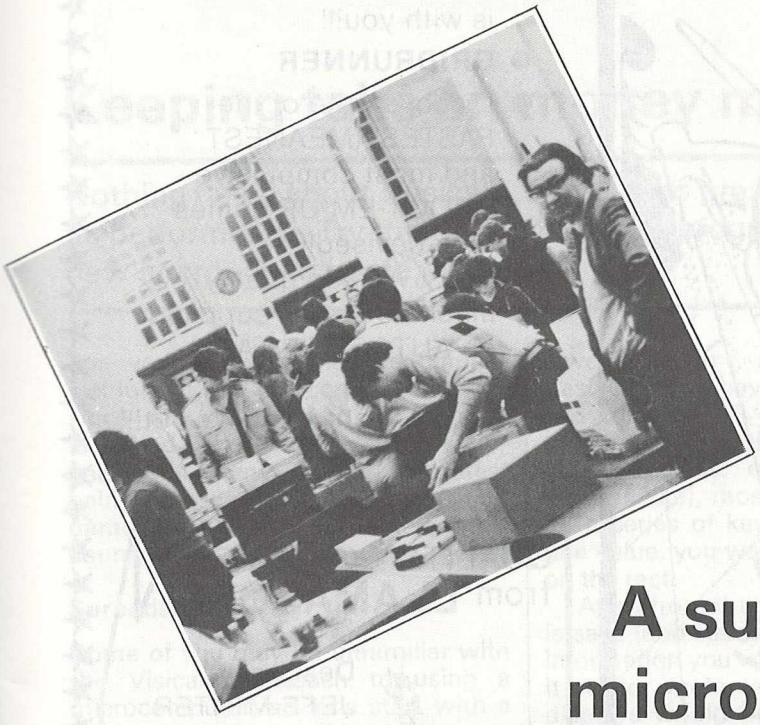
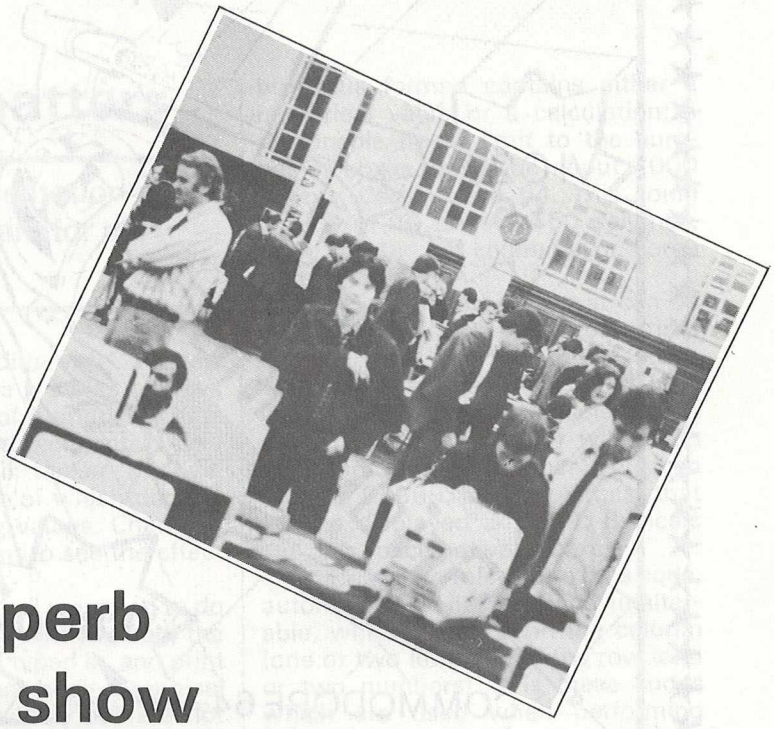
1-13 Corsham Street, London N1 6DP.
Telephone: 01-250 1978.
Telex: 943763 Ref. SHAMAH.





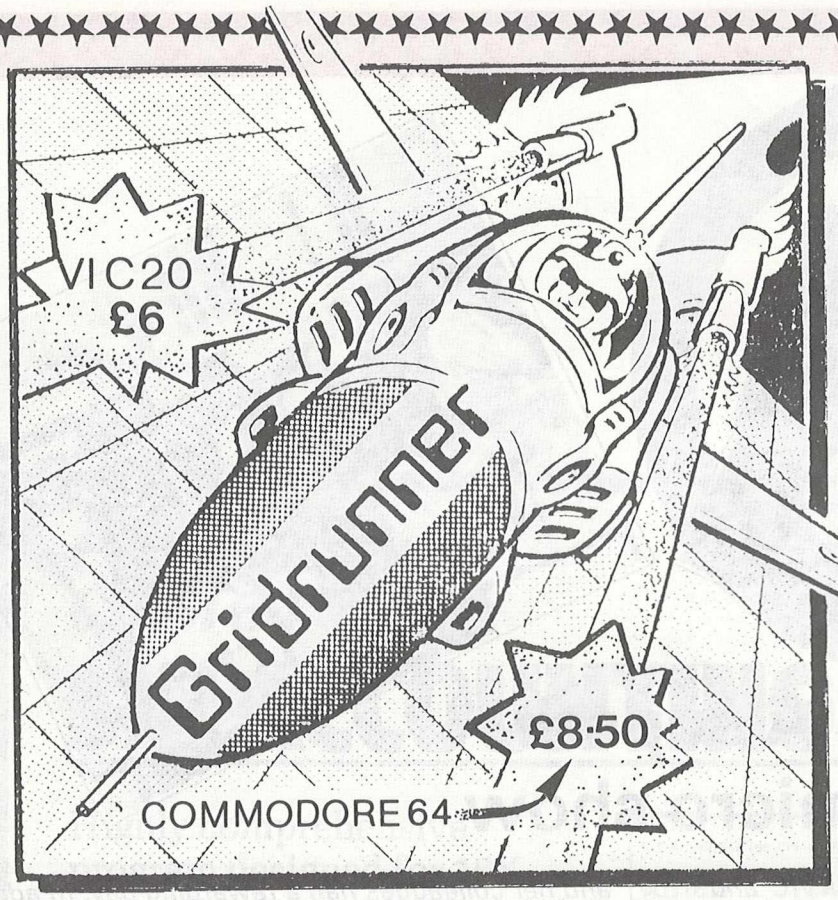
A superb micro show

The Commodore Computing International VIC and 64 Users Show at the Central Hall, Westminster proved to be a resounding success. The first show of the year specifically for VIC and 64 users, it was well attended and well received – an interesting day for exhibitors and visitors alike.

The organisers expected about 3,000 people to attend, so the final figure of almost 4,000 was a pleasant surprise. There were over 70 stands occupied by 30 of the leading UK VIC and 64 distributors, including Fox Electronics and their new 16K RAM cartridge. Judging by the crowds who gathered round the Rabbit Software stand, Heather Lamont and her colleagues had a rewarding day. In addition to the latest hardware and software, the show featured a wide range of peripherals.

The exhibition had its lighter side too. A number of visitors chose the occasion to sport outlandish costumes, with the result that sections of the hall occasionally resembled movie sets for Superman or Star Wars.

The success of the exhibition convinced the organisers of the need for microcomputer shows on a regular basis. Commodore Computing International looks forward to holding its second users show later this year.



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- K = Keyboard control
- J = Joystick control

For the unexpanded VIC

GRIDRUNNER (See Above) £6.00

ABDUCTOR
True arcade quality on the unexpanded VIC! Shoot down the segmented DROIDS invading the GRID. Beware of the PODS and ZAPPERS! The awesome speed, sound and graphics give you the BEST BLAST available!
J £6.00

BLITZKREIG
As seen at the Commodore show and reviewed by the Daily Telegraph. Fly your Vulcan Bomber over the enemy city and destroy the buildings. 25 levels of play, uses Hi-Res colour graphics and plays Rule Britannia between waves.
K £4.95

GAME GRAPHICS EDITOR
Create your very own custom characters for the unexpanded VIC 20, up to 64 characters with facilities such as reflect and save on cassette etc.
K

SOFTKEY 24
This program, designed to run on the VIC 20 with any memory size gives you the facility of 24 keywords on your function keys. Key words include peek, poke, run, save, list for next etc.
k **Both programs on one cassette** £6.00
With full documentation

For the expanded VIC (8K+)

ANDES ATTACK
Fly your ramjet fighter over the Andes mountain range and protect your llamas from kidnap by hostile UFOs. Features 5 kinds of UFO, controls include up, down, reverse, fire, thrust and smart bomb. Entirely machine code.
J £8.00

TRAXX
Paint around boxes to gain points whilst avoiding pursuing bugs. Capture corners and you can lunch off the bugs! Colourful Hi-Res Graphics on a 25 x 30 screen area and superb musical sound effects. 81 skill levels and 1/2 player options.
J £6.00

COMMODORE 64

GRIDRUNNER (See Above) £8.50

ATTACK OF THE MUTANT CAMELS
Planet Earth needs you! Hostile aliens have used genetic engineering to mutate camels from normally harmless beasts into 90 foot high, neutronium shielded, laser-spitting death-camels!! Can you fly your tiny, manoeuverable fighter over the mountainous landscape to weaken and destroy the camels before they invade the human stronghold? You must withstand withering laser fire and alien UFOS. Game action stretches over 10 screen lengths and features superb scrolling, scanner 1/2 player options and unbelievable animation. Play this game and "you'll never be able to visit a zoo again without getting an itchy trigger finger! Awesome Action!!
J £8.50

ROX 64
Rox is a challenging game involving the defence of your lunar base from a deadly meteor shower. Rox 64 includes amazing spritegraphics displays and spacey sound effects, and an awesome 'mothership' display if you win the game. Top 10 scores are tabled along with their names. This program shows just what can be achieved using only Commodore 64 Basic. Study the listing and learn how to use sprites and sound on this outstanding machine.
K £4.95

Keeping tabs on money matters

Nothing fancy about Busicalc, either in its presentation or its performance. Try this handy business program for a new approach to home finances.

The world of spreadsheets and financial forecasting has come a long way since the day when Visicalc was launched. Son of Visicalc has appeared in many guises, the latest being a product with the interesting name of Busicalc, available in this country from Supersoft.

Spreadsheets

Some of you may be unfamiliar with the Visicalc approach to using a microcomputer, so let's start with a brief resume of what these programs are designed to do.

One of the obvious limitations of using a micro, apart from the amount of memory on board, is the size of the screen display. On Commodore kit this ranges from 22 columns by 23 rows for the VIC-20 to 80 × 25 for the larger machines.

Even this latter display is usually not enough if you want to do some long-term forecasting, so the idea of using the screen as a window was developed. In other words, when you move the cursor to the right or to the bottom of the screen it doesn't merely sit there but goes beyond, with new information appearing at the right (or bottom) while the old disappears to the left (or top).

Of course, it does not vanish forever. Moving the cursor back brings it all into view again.

That solves the limitations of screen display. Memory you can do very little about; most of these programs take up a lot of space and there's a limit to how much you can expand.

Functions

The idea behind any computer business program is to save time, and ultimately money. Also, just because a computer can perform a function does not mean that you *must* use the computer to perform that function. It must not only make life faster but also easier.

Any spreadsheet program is designed to perform a series of calculations (usually inter-related) that need to be done time after time, but always with different figures. Basically, you have a series of rows and columns full of numerical information (household accounts, cash flow forecasts, oil tanker budgets and the like), most of which depend on a series of key values. Changing one value, you want to see the effect on the rest.

Apart from that, all you need to do is save (and subsequently reload) the information you've typed in, and print it out for a reference copy. Graphical displays would be nice but are not essential. There are many features that one would wish to see incorporated in such a program, but to consider these one must consider Busicalc itself.

The number of boxes that can be seen on the screen at one time depends on the width of each column, which also determines how much information is displayed.

As with previous Supersoft products, the packaging is spartan, to say the least. Still, you know they haven't increased the price of the product by wasting money on lurid multicolour designs for cassette cases etc. The manual is concise and to the point, the disk (or cassette) is simply labelled and packaged, and you know that you're paying for what you asked for and no more.

There are no dongles or protected disks. Just a brief copyright wording on the screen when the program is loaded, with a short statement in the manual: please respect the copyright; it represents the author's livelihood.

Up and running

There are a number of different versions of Busicalc. The Commodore 64 version allows you to have a grid (i.e. spread) sheet with a column width of 5 to 18 characters and any number of rows from 20 to 99. Each box thus formed contains either a numerical value or a calculation; a reasonable upper limit to the number of boxes would be about 2000 for our Commodore 64. This could consist of 40 rows by 50 columns, 80 rows by 25 columns, or some such combination.

The number of boxes that can be seen on the screen at one time depends on the width of each column, which also determines how much information is displayed. A width of five characters will mean that the largest number you can enter is 99999, and the largest that will be displayed is 9999: Busicalc leaves a space between boxes.

All boxes are referred to by a code, automatically allocated and unalterable, which depends on the column (one or two letters) and the row (one or two numbers). It is these codes which are used when performing calculations.

We lose three lines of the screen display: one for program name and copyright message, one for questions asked during program operation, and one for your reply to those questions.

To begin with the question line is blank, and the cursor flashes expectantly on the line below to await your input. A larger version of the cursor (a bar) is shown in the top left hand corner of the sheet, in box A1, indicating that this box is the one we're currently working on.

Data entry

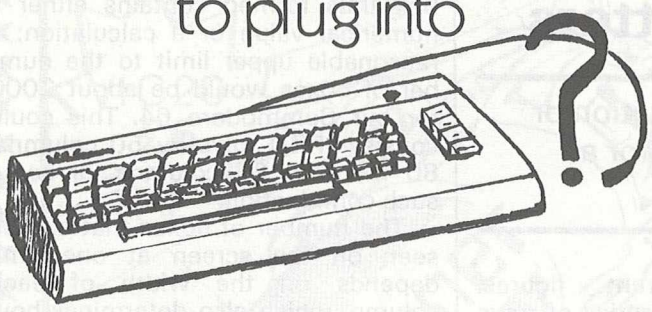
Either words or figures can be displayed in the boxes; these are typed in as normal (delete, insert etc. all work as usual in this entry mode). Usually, however, you would not be typing in figures all the time, but just a key figure to begin with from which all the rest will be obtained.

Box B2 for instance (let's assume you lose one row and one column for titling purposes) might contain your salary per month: call it 450.00, or however many decimal places you care to specify (if a calculated value has too many decimal places it is rounded in the usual way; too few and it's padded with zeros).

Take the contents

One third of your salary might go on your mortgage, so we could enter in box C2 either 150.00 or, to make life easier, +B*.33. This means 'take the contents of box B2 and multiply them by 0.33.'

Your Vic needs a friend to plug into



So Whymark have developed a decent printer, the new 855, to plug directly into the serial port of your VIC-20 or 64. Features include:-

up to 132 columns
120 characters persecond
bidirectional printing
graph plotting
changable character sets
bar charts
ideal for labels

The 855 is an intelligent printer whose characteristics can be changed by ASCII characters embedded in the text to centre headings and justify both ends of the lines of text. Large printing, 20mm high, is available as standard, and the tractor can be driven bi-directionally for ease of label removal. You can design your own special characters printed by a single letter. Borders can be designed by Commodore graphics or by the dot addressing facility. There is a 1000 character buffer and the printer will take normal 8½ inch fanfold, or an internally held paper roll.

WHYMARK Instruments Ltd

6 Holmesdale Road, Reigate, Surrey. Tel: (07372) 21753/21937. Telex: 296663.

commodore 64

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Star Trek 24K of Galactic adventure for only £7.00
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Only £7.00
With amazing Sprite Graphics.

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CBM-64 PET & VIC-20 SOFTWARE

SYNTHY-64 **£14.95**

Music and sound synthesiser for the CNM-64. The CBM-64 has the most sophisticated sound capabilities of any personal computer. However, these facilities are difficult to use from BASIC, requiring a series of 'POKE' commands. SYNTHY-64 makes it easy to create music using simple commands. The package includes a detailed manual and sample compositions.

PIPER **£9.95**

The music capabilities of VIC are rather less sophisticated than those of the CBM-64, but PIPER provides many of the facilities of SYNTHY-64 to make music composition simple on the unexpanded VIC. A version of PIPER is also available for the PET.

SCREEN GRAPHICS-64 **£14.95**

Adds more than 20 powerful commands to Basic to plot points, draw lines, circles and boxes, use sprites and even display text with graphics. SCREEN GRAPHICS-64 gives you High Resolution, Multicolour, and Sprite graphics all in one package. Two screens are provided — one for normal text and one for graphics — and you can switch between the two using the function keys or under programme control.

GRAPHVICS **£12.95**

Provides many of the features of SCREEN GRAPHICS-64 for the VIC with 3k or 8k + expansion.

SPRITE AID **£9.95**

Define SPRITES on your CBM-64's screen using the keyboard or joystick. Save the sprites as data statements for use in your own program using the 'sprite aid access routine'. A demonstration program and manual are included.

Software is provided on cassette, or on disk for £1.50 extra. Deduct 10% when ordering two or more packages. All prices are fully inclusive. Add £1.00 per item for overseas airmail. Dealer enquiries invited.

Send SAE for catalogue of games, language and utility software for all CBM computers.

ADAMSOFT,

18 Norwich Avenue, Rochdale, Lancs. OL11 5JZ.

Of course, formulae can be more complicated than this. They are only limited by the width of the screen, less two characters. Thus on the 64 we can have formulae up to 38 characters long. Normal arithmetical rules are obeyed, but unfortunately you cannot use brackets, and all calculations are carried out from left to right. Thus 6+2*8 is equal to 64, rather than 22 as you might expect. Still, a little logical thought will soon solve any problems.

As well as ordinary arithmetical operators, there are a couple of special ones. "&", for instance, sums a whole row or column. Reverse backslash finds the mean, < the lowest and > the highest value in an area.

And so we go on, creating boxes and interrelating them, until we end up with a series of calculations for the month. Now perhaps you want to extrapolate over the whole year, but don't really want to type in herds of entries again. Busicalc has a feature called Replicate, which allows reproduction of a series of boxes.

By hitting the backslash key ("/") we bring up the Busicalc function menu, which gives us 11 new commands.

> Most of the information depends on a series of key values. Changing one value, you want to see the effect on the rest.

Replicate can take a single box, a row, a column or a rectangle and reproduce the whole lot wherever we want it to be. Once replicated, formulae can be modified according to their new position on the sheet.

From these special function commands we can insert rows or columns, delete them, print a whole work sheet (or a rectangular part of it) format all the columns (with optional commas to make large numbers easier to read, e.g. 654,321 rather than 654321), find out how much memory is left, and so on.

Finally we have JUMP and WALK, JUMP for rapid movement around the sheet, WALK for moving in a specified horizontal or vertical direction whenever RETURN is pressed.

You'll be pleased to know that sheets can be saved and loaded again from this function menu.

And that's it! All your information is entered, and merely by changing one value (say a pay rise in our earlier example) every other value can be immediately altered to see what effect this change has.

Conclusion

At a price of £39 it is obvious that Busicalc will not have the features of its bigger brothers: split screens, graphics, processing a disk file as if it were a keyboard entry, and so on. However, as an introduction to spreadsheets it is worth looking at and being a piece of software for the 64, it becomes invaluable.

Program; Busicalc.
Price; £39 for tape version.
Configuration; Commodore 64 and cassette deck.
Company; Supersoft.
Address; Winchester House, Canning Road, Harrow, Middlesex.
Tel; 01-861 1166.

VIC 20 USERS!

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22 Hambridge Road, Newbury, Berks. RG14 5SU. Tel: 0635 30880

Chatterbox – a voice peripheral for the VIC-20

It may sound like the paranoid android, but this Adman synthesizer offers the user an almost limitless vocabulary, and the ability to create complex sentences

Given the sound capabilities of the VIC, it comes as no surprise that a voice synthesizer is now available for it. Marketed and manufactured by Adman Electronics it was originally developed by Currah Computer Components. Adman are part of the Adam Leisure Group.

The heart of the synthesizer is a cartridge which plugs in at the back of the VIC, or into one of the slots on an expansion board, in the usual way. You can, if you like, have other cartridges there as well (e.g. memory expansion), and the Chatterbox will continue to function normally.

Once plugged in the machine will power up with the familiar VIC message, followed by a few words from Currah. The keyboard is now, in effect, live; any key you hit will produce a pronunciation of the relevant letter.

These are voiced normally, but if you prefer phonetic pronunciation, pressing the F1 function key will give you that effect. F1 toggles this mode on or off.

Speak to me!

The method of sound generation used is based on allophones, otherwise known as individual speech sounds. This gives the user the advantage of a virtually limitless vocabulary, rather than the restrictions imposed by Pulse Code Modulation or Linear Predictive Coding, two other methods of speech generation, which simply store each word individually.

With allophones each word is built up from these individual sounds; we can produce virtually any word in the English language. What we lose, however, is the ability to give words intonation and character: they sound rather flat, and bear more than a passing resemblance to Marvin the paranoid android, from Hitch-Hiker's Guide to the Galaxy. No bad thing, you might think!

To use all the allophones stored in the Chatterbox, rather than slowly driving yourself round the bend as letters keep being pronounced every time you touch the keyboard, pressing F3 followed by RETURN allows you to enter programming mode.

Programmed to talk

A typical word might look something like this:

H/E/L/O O/

The Chatterbox synthesizer

This would produce a passable imitation of the word hello. Using this method, we can also begin to construct programs that allow the input of words and, if compared to an appropriate 'allophoned' version of the word, pronounce that same word.

This could have many applications in the field of education, where speaking a computer response could have far more effect than simply displaying that response on the screen. A child would also be more likely to respond to a warning from a voice, rather than a visual image.

In case you're worried at this point, the manual does explain what all the allophones are, and how different versions apply in different circumstances.

Complicated

After an initial exploratory period, you'll find that using the Chatterbox becomes easy and straightforward; some fairly complicated sentences can be built up and pronounced. Thus programs can become truly interactive. One wonders when the first Adventure game, or Eliza impersonation, will appear in talking form.

This sort of novel package could have many uses in the computer field, not only in education but in talking arcade games (remember Gorf?) and perhaps even programming for the blind. The clear, concise manual gives a fair insight into how speech synthesis works. At just £49.95 it represents reasonable value for money.

Product: Chatterbox.
Configuration: VIC-20.
Price: £49.95.
Company: Adman Electronics.
Availability: Major retail outlets, Spectrum chain.
Tel: 0423-62642, 0621-740972.

Programmer's aid

One of the most powerful programmer's aids that appeared for the PET was called Power. Combining the talents of Brad Templeton and Jim Butterfield, it could hardly fail.

Now a version has appeared for the Commodore 64, containing all the features that users have come to know and love, with a lot more to make special use of the 64's capabilities.

Anyone programming in Basic will want to get a copy of this. As well as all the usual commands added to existing Basic by add-on chips of this type (auto, renumber, dump, find and change and so on) we have such exciting features as backward scrolling of listing and single letter keyword entry.

A single key can also be used to action a short basic program or a useful sub-routine.

We can change programs into data and analyse them, or even invent a program that writes data files that can be converted into a program. Code generators cannot be far away!

But it will probably find most use in the hands of the average Basic programmer. The extra commands available will save many hours at the keyboard.

Product: Power 64.
Price: £69.
Configuration: Commodore 64.
Company: Kobra Micro Marketing.
Address: PO Box 28, Henley-on-Thames, Oxon RG9 1PF.
Tel: 04912-2512.

BUSINESS AND PLEASURE ON THE 64!

The Commodore 64 is the ideal machine to combine business with pleasure. It has a typewriter keyboard and lots of memory — ideal for word processing or financial planning — plus some rather clever colour and sound chips that are just what you need for realistic arcade action.

BUSICALC is just the program for those who need to juggle with figures. You could use it to plan your household finances or your personal tax — but it's equally capable of handling much larger figures. If you've got a printer you'll be able to produce reports that are good enough to put before the board (or the bank manager) — but a printer isn't necessary, and neither is a disk drive. BUSICALC costs just £39 plus VAT on tape, or £40.50 on disk; there are versions at the same prices for the PET and VIC-20 (with 16k expansion).

The best word processor you can buy for the 64 is VIZAWRITE. The first thing you'll like is being able to use it right away — you won't have to re-read the manual ninety-four times to find out how to get started. The next is the wide range of printers you can use from the VIC printer to a Diablo or Qume — plus many others in between (like the Epson). Virtually any parallel printer can be operated off the User Port for the price of a simple cable, and features such as underlining, superscripts, subscriptions, and emphasised printing are easily accessed. Formatting on screen means that you can see the text as it will print before it prints — and this isn't the only resemblance between VIZAWRITE and dedicated word processing stations costing £10,000 or more. VIZAWRITE costs a mere £69 plus VAT on disk; a tape-based version should be available very soon.

MIKRO ASSEMBLER plugs into the cartridge port of the 64. As PET and VIC owners are already well aware, MIKRO makes writing machine code programs almost as easy as Basic, because it is a real assembler with LABELS. To help you write your program MIKRO has AUTO, DELETE, and FIND commands; to help you debug it there's a machine code monitor; and you can DISASSEMBLE from Basic or in the monitor! The TABLE commands displays or prints an alphabetically sorted symbol table after assembly — which is really fast (MIKRO will assemble 2k of code in just 20 seconds). If you are writing more than (say) 4k of code you may have to split your source code into several files, but MIKRO will automatically link these together at assembly time, loading them from tape or disk as appropriate. The MIKRO module costs £50 plus VAT; it could be the best investment you ever make.

With ARROW installed in your 64 the Commodore cassette unit LOADS AND SAVES PROGRAMS SEVEN TIMES FASTER! Almost as fast as the 1541 disk, in fact. There is however a small difference in price — because ARROW costs just £39 plus VAT. ARROW has its own load and save commands, so you can still load and save at normal speed if you should want to. ARROW is a tried and tested product that we've been selling on the PET for several years; now 64 owners can also benefit.

Now for the lighter side of our range. TANK ATAK, KAKTUS and MANGROVE are arcade games with colour and sound; a joystick is recommended, but is not esential. They each cost £8 plus VAT on cassette or £9.50 on disk. THE HITCH-HIKER'S GUIDE TO THE GALAXY is an adventure based (with the kind permission of Douglas Adams and Pan Books) on the characters and scenarios in the popular series. If you divide the price of £12 plus VAT (£13.50 on disk) by the number of hours you'll spend exploring the galaxy the answer will be a very small number indeed!

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Technical tips for the 64 and the VIC

The documentation accompanying the 64 is sparse, to say the least, so we felt it only fair that the notes and tips that do filter through ought to be passed on to a wider audience, and what better way of doing that than through the pages of **Home Computing**?

Readers are welcome to contribute items on the 64; we will publish as many as we can.

Thanks to Malcolm North and Stephen Beats of Commodore Business Machines and C. L. Emberey of Manchester for the following technical notes on the Commodore 64.

Transferring programs

C. L. Emberey

If you have tried to transfer programs from the PET to the 64 you will know that a simple cassette save will allow the program to be loaded on the 64 and listed, edited etc. If you have tried to do the reverse, say obtain a listing when you do not have a line printer of your own, you may have encountered problems.

The reason is, I think, that the 64 in performing a SAVE saves its start loading address. This causes the program to be loaded from 2048 on the PET, which unfortunately does not put the program where the PET's Basic is looking for it. Those familiar with the monitor can enter it and establish an initial line starting 0401 hex linked to 0801 hex.

The following will work from Basic and writes an initial line:

```
POKE 1025, 1:POKE 1026, 8
POKE 1027, 1:POKE 1028, 0
POKE 1029, 58
POKE 1030, 0
Or 1 REM
Establish link address
Establish line number
143 for REM
End of line
```

There are no guarantees that the resulting program can be edited on the PET, without SAVEing and re-LOADing.

Character sets

```
PET
POKE 59468, 12
POKE 59468, 14
64
POKE 53272, 21    upper case
POKE 53272, 23    lower case
```

Which key

Detect which key depressed by PEEK(203) remembering that 64 indicates no key, (PET is 255). The short program below will help in decoding the keyboard:

```
10PRINT PEEK(203) : GOTO 10
```

PET users of Basic greater than 1.0 will remember PEEK(151).

Repeat all keys

Simply POKE 650, 255 to enable and POKE 650, 0 to disable. Addresses 651 and 652 are also significant.

The 1515 printer

Under certain conditions, particularly when printing long lines, the 1515 printer may hang at the beginning of a new line.

This may be overcome by switching the screen off before the start of the printer routine with POKE 53265,11 and switching it back on with POKE 53265, 27 end of routine, or whenever a screen activity is required.

Note that this system hang does not occur when doing a listing.

CBM 64 RS232

The CBM 64 user port may be used as an RS232C interface with the addition of the VIC 1011a RS232C level converter.

The line protocol is set up according to the charts on page 352–353 of the CBM 64 programmers' reference guide.

When in multi-line mode the DSR signal must be true for the transmitter to operate, loss of this line results in a fatal error. If a permanent high is not available from the printer, DSR can be connected to RTS which is held high.

Before closing a file it is essential that the buffer is empty or its contents will be lost. If, however, CTS is

Screen pokes

A screen poke of less than 128 (rvs characters being over 127 are OK) may often give no apparent result. This is because the character is the same colour as the background. Moving the cursor to the POKEd location will make the character visible.

The event is caused because no colour has been established at the corresponding location on the colour memory map. However, characters are visible when a character has been printed at the location, thereby setting a colour in the colour map, or if the background colour has been changed. It is important to remember that a clear screen also clears the colour map. There are a number of ways to avoid this happening:

For a single colour only:

(a) Use only rvs characters or change the background colour after a clear screen.

(b) Print a screenful of characters, not spaces, with the cursor colour set to the desired colour. Alternatively, POKE all the corresponding colour addresses with a colour. Again a clear screen will destroy this. The process is rather slow anyway.

For one or more colours:

(c) Either POKE the selected colour codes to the necessary locations and avoid clear screen or use a double POKE each time. A double POKE has the advantage that even if the screen is cleared the colour is always re-established. The double POKE would be colour location and screen location:

```
POKE SCREEN + 54272,
COLOUR:
POKE SCREEN, CHARACTER
```

Additional execution time is usually not significant. For PET and 64 users the following conversions may be of use.

```
PET
POKE X, Y
64
POKE X + 32528, C C a colour
0–15
POKE X – 31744, Y a character
```

lost during the buffer being emptied transmission will stop; therefore before closing a check must be done to see if the buffers are empty and if not transmission must be restarted. For example:

```
10 OPEN 2,2,0,CHR$(8)+CHR$(17)
20 FOR X=1 TO 30 : I$ = STR$(X)
30 PRINT#2,"THE QUICK BROWN FOX
   JUMPS OVER THE LAZY DOG"I$
40 NEXT
50 IF ( PEEK(669) <> PEEK(670) )
   AND (ST AND 143) = 0 THEN
   SYS (61480) : GOTO 50
60 CLOSE2
```

Using the IEEE-488 card

The CBM 64 IEEE-488 card is soft-loaded from a ROM when the power is applied. It is located at $C800-$D000. The cartridge then checks for another cartridge (Z80 card or application) and executes the cartridge in the normal way.

The software in the cartridge can relocate the IEEE code but software must not use the ram-test/restore routines. Cartridge software must check that location $0258 contains a $49 (meaning IEEE-488 cartridge present) before calling RAMTAS and RESTOR.

```
move lda #<offset   ;load a with lo byte
                     of address offset
     ldx #>offset   ;load x with hi byte
                     of address offset
     sei            ;turn of interrupts
     jsr $c839      ;call move routine
                     (this moves to)
     cli            ;clear interrupts
     rts
```

The move routine is always at IEEE base address + $39.

Providing the software calls the vectored routines, all I/O operations are transparent.

Screen clearing NTSC and PAL

On the NTSC 64 with revision 1 Kernal ROMS, all pokes to the screen default to white because the colour nibbles are initialised to $01 when the screen is cleared. This is not the case on the PAL 64; instead, the colour nibbles are set to the same value as the screen background which makes any pokes to the screen invisible.

For this reason any machine code game must initialise the colour RAM on power-up if any large areas of the screen are to be accessed using direct stores to the video RAM. This

```
1000 ;GENERAL PURPOSE CLEAR SCREEN
1010 ;
1020 VMAT   =$0400              ;VIDEO MATRIX
1030 CMAT   =$D800              ;COLOUR MATRIX
1040 COLOUR =$03                ;OR SOMEWHERE ELSE ON Z/PAGE
1050 *=$3000                    ;FOR TEST ASSEMBLY
1060 ;
1070 ;
1080 CLS    LDX #0
1090 CLS0   LDA #32             ;LOAD ACC WITH SPACES
1100        STA VMAT,X
1110        STA VMAT+256,X
1120        STA VMAT+512,X
1130        STA VMAT+744,X      ;AVOID SPRITE POINTERS
1140 ;
1150        LDA COLOUR          ;GET COLOUR
1160        STA CMAT,X
1170        STA CMAT+256,X
1180        STA CMAT+512,X
1190        STA CMAT+744,X
1200        DEX
1210        BNE CLS0
1220        RTS
1230 ;
1240        .END
```

saves having to make two stores for everything that is to be displayed.

The code above is an example of a general purpose clear screen routine that does not use the Kernal print vector ($FFD2).

It should be noted that the start address of the video matrix should be set by the programmer in the power-up routines of the program. The execution time of this routine is 12808 cycles or about 1/78th of a second. Call the routine by first loading location COLOUR with the required value for the colour nibbles and then JSR CLS.

When poking to the screen in Basic it is essential to poke the colour RAM as well to ensure that the character is displayed. This is especially important after clearing the screen. Assuming that the variable SC has been set to the screen poke location, the following code will always make sure that the character poked is always set to the desired colour:

```
POKE SC,42:POKESC+54272,5
REM display a green asterisk at
location SC
```

NTSC sprites vs PAL sprites

When using sprites there are a few important points to be noted so that your program will run satisfactorily on both PAL and NTSC systems. These differences are mainly connected with the raster interrupts and the different locations at which a sprite will go off the edge of the screen.

To enable the program to determine the type of machine, there is a flag located at $02A6 which will contain 0 if the computer is NTSC or 1 if it is PAL. Of course this flag will only be conditioned if the 64 has done its own power-up routines. If this is not the case (i.e. the program is in a cartridge that does its own power-on clear) then the TV standard must be determined at the beginning of the program.

The code at the top of page 12 will determine the TV standard and condition three memory locations. FPS will contain the number of frames per second, MODH and MODL will contain the 16 bit modulus for the raster count.

Possible locations

This routine works on the fact that the NTSC system has 262 raster lines per screen while the PAL system is based on 312; therefore the presence of a raster 263 or greater would imply the PAL system.

There are $200 possible x locations for a sprite on an NTSC 64 but there are only $1F8 possible locations on the PAL system. Because positions $F8 through $1FF do not exist on PAL, problems can arise when moving an expanded sprite in the x direction so that it appears to "wrap" off the right-hand side of the screen and onto the left or when a sprite is to be prevented from disappearing from view. Hence the need to know which standard the program is running on.

```
1000 ;DETERMINE TV STANDARD
1010 ;
1020 *=$0002                ;OR SOMEWHERE ELSE ON Z/PAGE
1030 MODH    *=*+1
1040 MODL    *=*+1
1050 FPS     *=*+1
1060 RASHGH =$D011          ;RASTER MSB
1070 RASTER =$D012          ;RASTER LSB
1080 *=$3000                ;FOR TEST ASSEMBLY
1090 ;
1100 ;
1110 TVSTD   LDA #50        ;ASSUME PAL STANDARD FIRST
1120         STA FPS        ;PAL IS 50 FRAMES PER SECOND
1130         LDX #$01       ;SET UP PAL MODULUS HI BYTE
1140         LDY #$F8       ;SET UP PAL MODULUS LO BYTE
1150 TVSTD0  LDA RASHGH     ;IS MSB A 1 YET?
1160         BPL TVSTD0     ;<256 SO LOOK AGAIN
1170 TVSTD1  LDA #$08       ;RASTER >255 BUT....
1180         CMP RASTER     ;IS IT GREATER THAN 264
1190         BCS TVSTD2     ;IF YES THEN TV IS A PAL!
1200         LDA RASHGH     ;IF NO THEN CHECK MSB=1
1210         BMI TVSTD1     ;YES SO CHECK LSB AGAIN
1220         INX            ;SET UP NTSC MSB TV IS NTSC!
1230         LDY #$00       ;SET UP NTSC LSB
1240         LDA #60        ;SET UP NTSC FRAMES PER SECOND
1250         STA FPS        ;NTSC IS 60 FRAMES PER SECOND
1260 TVSTD2  STX MODH       ;STORE IN MODULUS FOR FUTURE USE
1270         STY MODL
1280         RTS            ;OR JMP TO USER PROGRAM
1290 ;
1300         .END
```

When it is required for a sprite to go off one edge of the screen and scroll back onto the other edge, the program should check to see if the sprite has reached position $1F8. If it has, then the positions from $1F8 through $1FF should be disallowed if the program is running on a PAL 64.

The following Basic program will move the sprite whose number has been placed in the variable SN and in the direction governed by the variable DN which will contain either +n or −n where n is any increment required.

Note that it is not necessary to make these checks when moving a sprite in the y direction as the on and off screen positions for a sprite are the same for both NTSC and PAL systems.

```
2000 REM SUBROUTINE TO MOVE SPRITES AND CHECK
2010 REM THAT WRAP AROUND IS OCCURING PROPERLY
2020 REM SET SN=SPRITE NUMBER  DN=DIRECTION
2030 P=0:BI=2↑SN:HB=PEEK(53264)ANDBI:IF HB THEN P=256
2040 P=P+PEEK(53248+SN*2)+DN:REM P=SPRITE POSITION
2050 TL=511:IF PEEK (678)THEN TL=504:REM 504=PAL
2060 IFP>TL THENP=0
2070 IFP<0THENP=TL
2080 POKE 53248+SN*2,P AND 255:REM SET LO BYTE
2090 IFP>255 THEN 2110
2100 POKE 53264,PEEK(53264)AND (255-BI):RETURN
2110 POKE 53264,PEEK(53264)OR BI:RETURN
```

Two-dimensional Rubik Cube

A two-dimensional version of the popular cube designed by Ernst Rubik, this game demands a high degree of concentration to solve the puzzle. All six faces of the cube are shown and one has to remember where the sides join. The program runs on a Basic VIC-20 with no expansion.

The primary instructions are to rotate a face of the (flat) cube. An anti-clockwise rotation is achieved by entering the number of the face to be moved. To rotate a face clockwise, a minus sign must be typed before the number.

Once you have completed the cube, or become stuck, hit the space bar, which ends the game. A choice of a different number of twists is given at the beginning of the next game to make it more easy or more difficult.

The following is a list of the more interesting lines that make up the program.

Line 40-50	Limits the top of memory for graphic characters.
70-80	Inputs the initial number of twists to mix up the cube.
100-230	Displays the cube on the screen.
240-290	Array F holds the centre poke location for each face.
300-310	Holds the character array for each face.
320–420	Poke locations for the rest of the pieces in each face.
520	Gosub to create characters.
530-570	Poke for character face and colour.
610-810	Rotates the faces.
890-1010	Inputs moves and decisions.
1020-1070	Inputs the cycle for mixing the cube.
1080-1150	Sets up graphic characters.
1160-1220	Character data.

```
10 REM RUBIK CUBE
20 REM ****************************************
30 REM
34 REM
35 REM LIMIT TOP OF MEMORY
36 REM
40 POKE 56,PEEK(56)-2:POKE 52,PEEK(56)-2
50 POKE 51,PEEK(55):CLR
60 DIMG(5,12):ZZ=30720:POKE36879,127
70 PRINT"□NUMBER OF TWISTS TO MIX"
80 INPUT"■ ";P
90 M=1
94 REM
95 REM DISPLAY CUBE
96 REM
100 PRINT"□"
110 DIMF(5,8)
120 PRINT"■■■      ┌─────┐"
130 PRINT"■      |5    |"
140 FORI=1TO4
150 PRINT"■      |     |":NEXT
160 PRINT"■┌─────┼─────┼─────┼─────┐"
170 PRINT"■|4    |1    |2    |3    |"
180 FORI=1TO4
190 PRINT"■|     |     |     |     |":NEXT
200 PRINT"■└─────┼─────┼─────┼─────┘"
210 PRINT"■      |6    |"
220 FORI=1TO4:PRINT"■      |     |":NEXT
230 PRINT"■      └─────┘■"
234 REM
235 REM SCREEN LOCATIONS OF CENTRE OF EACH FACE
236 REM
240 F(0,0)=7680+8+(12*22)
```

```
250 F(1,0)=7680+13+(12*22)
260 F(2,0)=7680+18+(12*22)
270 F(3,0)=7680+3+(12*22)
280 F(4,0)=7680+8+(6*22)
290 F(5,0)=7680+8+(18*22)
294 REM
295 REM CHARACTER FOR EACH FACE
296 REM
300 C(0)=58:C(1)=59:C(2)=60:
310 C(3)=61:C(4)=62:C(5)=63
314 REM
315 REM RELATIVE POSITIONS OF PIECES TO CENTRE
316 REM
320 FORI=0TO5
330 K=F(I,0)
340 F(I,1)=K-23
350 F(I,2)=K-22
360 F(I,3)=K-21
370 F(I,4)=K+1
380 F(I,5)=K+23
390 F(I,6)=K+22
400 F(I,7)=K+21
410 F(I,8)=K-1
420 NEXT
430 FORI=0TO5
440 FORJ=0TO9STEP3
450 READN
460 FORK=1TO3
470 READN2
480 G(I,J+K)=F(N,N2)
490 NEXT
500 NEXT
510 NEXT
520 GOSUB 1080:POKE 36869,255
524 REM
525 REM DISPLAY ACTUAL PIECES OF CUBE
526 REM
530 FORJ=0TO5
540 FORI=0TO8
550 POKEF(J,I),C(J):POKEF(J,I)+ZZ,C(J)-58
560 NEXT
570 NEXT
580 IFP<=0THEN1010
590 GOTO880
599 REM
600 REM MOVE PIECES
601 REM
610 S1=PEEK(F(I,1))
620 S2=PEEK(F(I,2))
630 FORJ=1TO6
640 POKEF(I,J),PEEK(F(I,J+2)):NEXT
650 POKEF(I,7),S1
660 POKEF(I,8),S2
670 S1=PEEK(G(I,1))
680 S2=PEEK(G(I,2))
690 S3=PEEK(G(I,3))
700 FORJ=1TO9
710 POKEG(I,J),PEEK(G(I,J+3))
720 NEXT
```

```
730 POKEG(I,10),S1
740 POKEG(I,11),S2
750 POKEG(I,12),S3
760 FOR J=0 TO 5
770 FOR I=0 TO 8
780 POKE F(J,I)+ZZ,PEEK(F(J,I))-58
790 NEXT I
800 NEXT J
810 RETURN
820 DATA4,7,6,5,1,1,8,7,5,3,2,1,3,5,4,3
830 DATA4,5,4,3,2,1,8,7,5,5,4,3,0,5,4,3
840 DATA4,3,2,1,3,1,8,7,5,7,6,5,1,5,4,3
850 DATA4,1,8,7,0,1,8,7,5,1,8,7,2,5,4,3
860 DATA2,3,2,1,1,3,2,1,0,3,2,1,3,3,2,1
870 DATA0,7,6,5,1,7,6,5,2,7,6,5,3,7,6,5
880 FORX=1TOP:I=INT(RND(1)*6):GOSUB600:NEXT
884 REM
885 REM INPUT MOVE
886 REM
890 PRINT"■■■MOVE:1-6":PRINT"■      OR-"
900 IFM>2THENPOKE7680,173
910 IFM<2THENPOKE7680,160
920 POKE38400,0:GETA$
930 IFA$=""THEN920
940 IFA$="-"THENM=M+2:M=MAND3:GOTO890
950 IFA$<>" "THEN970:REM RESTART
960 POKE 56,PEEK(56)+2:POKE36869,240:RUN
970 A=VAL(A$):IFA=0THEN920
980 IFA>6THEN920
990 FORN=1TOM:I=A-1:GOSUB600:NEXT
1000 M=1:GOTO890
1010 IFP=0THEN890
1020 INPUT"■GROUP CYCLE- STRING";G$
1030 INPUT"■NUMBER OF CYCLES          ■■■■■■■■■■";NC
1040 IFNC<1THEN1020
1050 FORCY=1TONC:FORGG=1TOLEN(G$)
1060 I=VAL(MID$(G$,GG,1))-1:GOSUB600:NEXT:NEXT
1070 GOTO1030
1074 REM
1075 REM SET UP GRAPHICS CHARACTERS
1076 REM
1080 FOR I=1 TO 7
1090 READ X
1100 FOR J=0 TO 7
1110 READ K
1120 POKE X+J,K
1130 NEXT J
1140 NEXT I
1150 RETURN
1154 REM
1155 REM CHARACTER DATA
1156 REM
1160 DATA 7424,0,0,0,0,0,0,0,0
1170 DATA 7632,0,127,127,127,127,127,127,127
1180 DATA 7640,0,127,127,127,127,127,127,127
1190 DATA 7648,0,127,127,127,127,127,127,127
1200 DATA 7656,0,127,127,127,127,127,127,127
1210 DATA 7664,0,127,127,127,127,127,127,127
1220 DATA 7672,0,127,127,127,127,127,127,127
READY.
```

Have fun with Sprite

This month we are concentrating on the 64. The following listing is for a sprite editor for the 64. A sprite is a block 24 pixels wide by 21 pixels high which is stored in a 63 byte area of memory (it is possible to have 255 different sprites defined, but only eight may be displayed on the screen at any one time).

The sprite can be moved anywhere within the screen and will not disturb any display already on the screen; it passes over the top of the display. Although with the VIC you can define your own characters, they can only be moved around the screen in the character positions. Sprite on the other hand may be moved in distances of one pixel, thus giving the effect of continuous movement.

> A display that can be moved anywhere on the screen and will not disturb any other display.

The sprites are controlled using the 47 registers from the video chip starting at address 53248(dec). Now follows a diagram of these registers.

```
Address      Description
00  ($00)    Sprite 0 x position
01  ($01)    Sprite 0 y position
02  ($02)    Same as 0 and 1 for sprites 1-7


15  ($0F)
16  ($10)    M.S.B of x position. SP0 in bit 0  SP1 in bit 1 etc.
18  ($12)    Raster Register
19  ($13)    Light Pen x coord
20  ($14)    Light Pen y coord
21  ($15)    Sprite Enable. SP0 in bit 0  SP1 in bit 1 etc.
23  ($17)    Sprite Expand in y. SP0 in bit 0  SP1 in bit 1 etc.
24  ($18)    Memory Pointers (bit 0 not used)
25  ($19)    Interrupt register (bits 4,5,6 not used)
26  ($1A)    Enable Interrupt (bits 4,5,6,7 not used)
27  ($1B)    Sprite data priority. SP0 in bit 0  SP1 in bit 1 etc.
28  ($1C)    Sprite Multicolour Select. SP0 in bit 0  SP1 in bit 1 etc.
29  ($1D)    As 23 but for x
30  ($1E)    Sprite to Sprite Collision.SP0 in bit 0  SP1 in bit 1 etc.
31  ($1F)    Sprite data Collision. SP0 in bit 0  SP1 in bit 1 etc.
32  ($20)    Exterior Colour
33  ($21)    Background colour #0
34  ($22)    Background colour #1
35  ($23)    Background colour #2
36  ($24)    Background colour #3
37  ($25)    Sprite Multicolour #0
38  ($26)    Sprite Multicolour #1
39  ($27)    Sprite 0 Colour
40  ($28)    Same for Sprites 1-7
 .     .
 .     .
46  ($2E)

 In registers 32-46,bits 4,5,6,7 are not used.
```

The program allows you to define sprite 0 using block 13 for the data. Block 13 starts at location 832(dec). The pointers for the sprites are stored in locations 2040–2047(dec), therefore to define sprite 0 using block 13, the syntax is POKE 2040,13 or more generally POKE 2040+sp#,b1#.

When you are happy with your sprite, type 0,0,0 and you can choose the sprite colour and expand in both the x and y axis. When you are happy with that, 0,0,0 allows you to move the sprite around the screen using the cursor control keys.

Typing E will give you the choice of returning to edit the sprite further or to end the program. If you choose to end the program, it will write the sprite as DATA statements to lines 60000–60006.

```
100 :
110 REM A SPRITE DRAWER          C64
120 :
130 REM C.L.EMBEREY              23/01/83
140 :
150 REM DEFINE FIXED VARIABLES
160 :
170 S=1024              :REM SCREEN MAP
180 C=55296             :REM COLOUR MAP
190 SD=2040             :REM S BLOCK POINTER
200 V=53248             :REM VIDEO CHIP
210 RS=160              :REM POKE REVERSE SPACE
220 SP=32               :REM POKE SPACE
230 DIM A$(62),B(62)    :REM S DATA ARRAYS
240 DIM B$(62),D$(62):REM AS ABOVE
300 :
310 REM INSTRUCTIONS
315 :
320 POKE 53272,23       :REM LOWER CASE
330 PRINT"■";SPC(11);"■SPRITE GENERATOR■"
340 PRINT"A SPRITE IS A 24 WIDE BY 21 HIGH DOT"
350 PRINT"PICTURE.   EACH LINE IS MADE UP OF"
360 PRINT"THREE BYTES OF DATA.   TO GENERATE"
370 PRINT"A SPRITE 63 BYTES ARE THEREFORE NEEDED."
380 PRINT"WITHIN A BYTE A BIT SET TO 1=DOT ON."
410 PRINT"THE FOLLOWING PROGRAM ALLOWS YOU TO"
420 PRINT"GENERATE SPRITE 0,CHANGE ITS COLOUR AND"
440 PRINT"MOVE IT. IN THE LARGE PICTURE A SPACE=0"
450 PRINT"AND A RVS SPACE=1.   THE EFFECTS OF"
460 PRINT"CHANGING THE CONFIGURATION MAY BE SEEN"
470 PRINT"ON THE SPRITE ON THE RIGHT OF THE "
490 PRINT"SCREEN. TO ADVANCE TO THE NEXT STAGE"
510 PRINT"SYMPLY TYPE 0,0,0 AFTER THE PROMPT."
520 PRINT"ON ENDING THE PROGRAM THE SPRITE DATA"
530 PRINT"WILL BE WRITTEN AS LINES 60000-60206"
540 PRINT"OF THE PROGRAM."
550 PRINT"THIS MAY THEN BE MERGED TO ANOTHER"
555 PRINT"PROGRAM BY LISTING 60000-,LOADING AND"
556 PRINT"PRESSING RETURN AT EACH LINE."
557 PRINT
562 PRINT"PRESS ANY KEY TO CONTINUE";
570 GET Y$:IF Y$="" GOTO 570
575 PRINT"■"
580 POKE 53272,21       :REM UPPER CASE
590 :
600 REM SET UP PICTURE
610 :
620 FOR I=0 TO 62       :REM DATA TO BLOCK 13
630 READ A
640 POKE 832+I,A        :REM PUT DATA BL13
645 A$(I)="11111111" :REM START VALUES
646 D$(I)="■ ■■■ ■■■ ■■■ ■■■ ■■■ ■■■ ■■■ ■"
647 B(I)=255:B$(I)=" 255"
650 NEXT I
660 DATA 255,255,255 :REM LINE 1
670 DATA 255,255,255 :REM LINE 2
680 DATA 255,255,255 :REM LINE 3
690 DATA 255,255,255 :REM LINE 4
700 DATA 255,255,255 :REM LINE 5
710 DATA 255,255,255 :REM LINE 6
720 DATA 255,255,255 :REM LINE 7
730 DATA 255,255,255 :REM LINE 8
740 DATA 255,255,255 :REM LINE 9
```

```
750 DATA 255,255,255 :REM LINE 10
760 DATA 255,255,255 :REM LINE 11
770 DATA 255,255,255 :REM LINE 12
780 DATA 255,255,255 :REM LINE 13
790 DATA 255,255,255 :REM LINE 14
800 DATA 255,255,255 :REM LINE 15
810 DATA 255,255,255 :REM LINE 16
820 DATA 255,255,255 :REM LINE 17
830 DATA 255,255,255 :REM LINE 18
840 DATA 255,255,255 :REM LINE 19
850 DATA 255,255,255 :REM LINE 20
860 DATA 255,255,255 :REM LINE 21
870 POKE SD,13        :REM S0 WHERE DATA
871 POKE V+16,1       :REM S0 MSB X COORD.
872 POKE V+0,55       :REM S0 LSB X
873 POKE V+1,227      :REM S0 LSB Y
874 POKE V+21,1       :REM S0 APPEAR
875 POKE V+39,7       :REM YELLOW
876 :
877 REM SET UP PICTURE
880 PRINT"□  ABCDEFGHIJKLMNOPQRSTUVWX"
900 FOR I=1 TO 21
910 PRINTMID$(STR$(I)+" ",2,2);
920 PRINTD$((I-1)*3);D$((I-1)*3+1);D$((I-1)*3+2);
925 PRINTB$((I-1)*3);B$((I-1)*3+1);B$((I-1)*3+2)
930 NEXT I
1000 :
1010 REM CREATE PICTURE
1020 INPUT"LETTER,NO.,1/0";L$,N,O$:O=VAL(O$)
1025 IF L$="0" GOTO 2000
1030 SQUARE=N*40+2+ASC(L$)-65
1040 POKE C+SQUARE,14 :REM COLOUR
1050 IF O=0 THEN POKE S+SQUARE,32
1060 IF O=1 THEN POKE S+SQUARE,160
1070 REM CHANGE DATA
1080 BYTE=(N-1)*3+INT((ASC(L$)-65)/8)
1090 Q=INT((SQUARE-2)/8)*8+2:B=0
1100 FOR I=Q TO Q+7
1110 F=PEEK(S+I)
1120 IF F=160 THEN O$="1":OO$="▌ "
1130 IF F=32  THEN O$="0":OO$="▐ "
1140 A$=LEFT$(A$(BYTE),I-Q)+O$
1145 A$=C$+RIGHT$(A$(BYTE),Q+7-I)
1150 D$=LEFT$(D$(BYTE),(I-Q)*3)+OO$
1155 D$=D$+RIGHT$(D$(BYTE),(Q+7-I)*3)
1170 A$(BYTE)=A$              :REM BINARY
1175 D$(BYTE)=D$              :REM PICTURE
1180 B=2↑(Q+7-I)*VAL(O$)+B:REM DECIMAL
1190 NEXT I
1200 B(BYTE)=B
1210 B$(BYTE)=RIGHT$("   "+STR$(B),4)
1215 B$=RIGHT$("   "+STR$(B),3)
1220 D1=VAL(MID$(B$,1,1))
1230 D2=VAL(MID$(B$,2,1))
1240 D3=VAL(MID$(B$,3,1))
1250 D=N*40+26+(BYTE-INT(BYTE/3)*3)*4
1260 POKE C+D+1,14:POKE S+D+1,48+D1
1270 POKE C+D+2,14:POKE S+D+2,48+D2
1280 POKE C+D+3,14:POKE S+D+3,48+D3
1290 POKE 832+BYTE,B(BYTE)
1300 POKE SP,1
1305 PRINT"□                                    □"
```

```
1310 GOTO 1000
2000 :
2005 REM CHANGE COLOUR
2010 PRINT"■                                        ■"
2020 INPUT"COLOUR 0-14,SIZE S/L,DIR X/Y";C$,SI$,DI$
2021 REM CHECK NOT JUST BLACK
2025 IFC$="0"ANDSI$="0" GOTO 3000
2030 OC=VAL(C$)
2040 POKE V+39,OC    :REM CHANGE COLOUR AND SIZE
2041 IFSI$="S"ANDDI$="X" THEN POKE V+29,0
2042 IFSI$="L"ANDDI$="X" THEN POKE V+29,1
2043 IFSI$="S"ANDDI$="Y" THEN POKE V+23,0
2044 IFSI$="L"ANDDI$="Y" THEN POKE V+23,1
2050 PRINT"■                                        ■"
2060 GOTO 2020
3000 :
3005 REM MOVE SPRITE
3010 PRINT"■                                        ■"
3020 PRINT"CURSOR KEYS TO MOVE SPRITE E=END"
3025 Y=227 :X=256+55:REM INITIAL VALUES
3030 GET A$
3035 IF A$="E" GOTO 4000
3040 IF A$="■" THEN Y=Y+1
3050 IF A$="■" THEN Y=Y-1
3060 IF A$="■" THEN X=X+1
3070 IF A$="■" THEN X=X-1
3080 IF X<24 THEN X=24:REM KEEP ON SCREEN
3090 IF X>320 THEN X=320
3100 IF Y<40 THEN Y=40
3110 IF Y>240 THEN Y=240
3180 POKE V+16,INT(X/256):REM MSB X COORD
3190 POKE V+0,X-INT(X/256)*256:REM LSB X COORD
3200 POKE V+1,Y:REM Y COORD
3210 GOTO 3030
4000 :
4005 REM OPTIONS
4006 :
4010 PRINT"■■YOU MAY:■■"
4020 PRINT"1.AMEND SPRITE"
4040 PRINT"2.END AND SAVE SPRITE DATA IN"
4050 PRINT"  LINES 60000-60070"
4060 INPUT"SELECT";R
4070 IF R=1 GOTO 870
4080 IF R<>2 GOTO 4000
5000 :
5010 REM WRITE DATA
5020 PRINT"■■■";
6030 FOR I=1 TO 7
6040 PRINT60000+(I-1);"D■";
6050 FOR J=1 TO 9
6060 PRINTB((I-1)*9+(J-1));
6070 IFJ<9 THEN PRINT",";
6080 NEXT J
6085 PRINT
6090 NEXT I
6100 PRINT"■";
6110 POKE 198,7:REM NO.OF CHARS IN K/B BUFFER
6120 FOR I=631 TO 637:REM K/B BUFFER
6130 POKE I,13:NEXT I
6140 END

READY.
```

Sound interfacing

This program outlines the use of the sound interface device (SID) on the 64 to experiment with the different sounds that can be generated. The sound output of the SID consists of three voices each with the same facilities. These voices each have four different waveforms available: Noise, Square, Sawtooth and Triangular.

The waveforms may be used on their own or ANDed together to produce more interesting sounds. The accompanying program, however, only allows you to use one voice at one time and with only one waveform per voice.

The sound registers start at location 54272(dec). They are as shown on the right.

Sound registers

```
Reg #        Description
00-06  ($00-$06)      Voice 1

00  ($00)    Lo bits of frequency
01  ($01)    Hi bits of frequency
02  ($02)    Pulse width Lo bits
03  ($03)    Pulse width Hi bits (only bits 0-3 are used)
04  ($04)    Control Register:
                bit      use
                 0       Gate
                 1       Sync
                 2       Ring Mod
                 3       Test
                 4       Triangle wave
                 5       Sawtooth wave
                 6       Square wave
                 7       Noise
05  ($05)    Attack (bits 4-7)/Decay  (bits 0-3)
06  ($06)    Sustain(bits 4-7)/Release(bits 0-3)

07-13  ($07-$0D)      Voice 2

14-20  ($0E-$14)      Voice 3

24  ($18)    Mode(bits 4-7)/Vol(bits 0-3)
```

Control output

The attack, decay, sustain and release values are the values that control the output of the sound, the envelope.

Attack: The time it takes to get the output to the maximum amplitude.
Decay: The time it takes to drop to the sustain level.
Sustain: The level at which the note will remain until the release cycle is started. These three cycles are started when the gate (bit 0 of control reg.) is set to 1. When the gate is reset to 0, the release cycle starts.
Release: The time it takes to drop from sustain to zero amplitude.

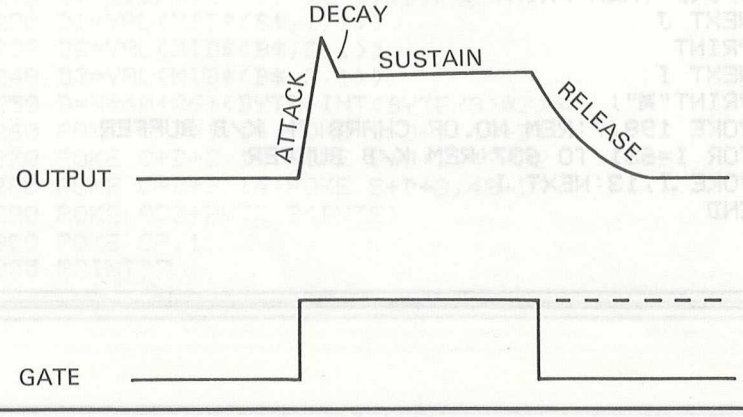
Value (dec)	Attack rate (ms)	Dec/Rel rate (ms)
0	2	6
1	8	24
2	16	48
3	24	72
4	38	114
5	56	168
6	68	204
7	80	240
8	100	300
9	250	750
10	500	1500
11	800	2400
12	1000	3000
13	3000	9000
14	5000	15000
15	8000	24000

The value that goes into the frequency registers is:

Freq(Hz) = ((freq in reg)*0.05965)Hz

The freq in reg is a value between 0 and 65535.

The pulse width only affects the square wave and ranges from 0–4095. A pulse width of 0 or 4095 gives no audible sound.



```
10 REM DEMONSTRATION PROGRAM TO
20 REM USE THE SOUND INTERFACE
30 REM DEVICE (SID)
40 REM
100 S=54272:REM REGISTER 0 OF SID
110 DIM K(11)
120 FOR I=0 TO 11 :REM FREQUENCY ARRAY
130 READ X
140 K(I)=X
150 NEXT I
160 DATA 274,291,308,326,346,366
170 DATA 388,411,435,461,489,518
180 REM INSTRUCTIONS
185 POKE 53280,2:POKE 53281,2:PRINT"■"
190 PRINT"■USE KEYS:■ Q W E R T Y U ■"
200 PRINT"TO SELECT NOTE (SHIFTED FOR SHARP)"
210 PRINT"■F1-F8  ■TO SELECT OCTAVE"
220 PRINT"■1-3    ■TO SELECT VOICE"
230 PRINT"■0      ■TO TURN OFF NOTE"
240 PRINT"■6-9    ■TO SELECT WAVEFORM"
250 PRINT"■Z      ■TO INCREASE OR DECREASE ATTACK"
260 PRINT"■X      ■TO INCREASE OR DECREASE DECAY"
270 PRINT"■C      ■TO INCREASE OR DECREASE SUSTAIN"
280 PRINT"■V      ■TO INCREASE OR DECREASE RELEASE"
285 PRINT"■P      ■TO CHANGE PULSE WIDTH"
290 PRINT" (■SPACE■ TO INCREASE, ■DEL■ TO DECREASE)"
300 PRINT"■RETURN ■TO ALTERNATE GATE":PRINT
310 POKE S+24,15
320 FOR I=0 TO 2
330 POKE S+5+7*I,17:A(I)=1:D(I)=1
340 POKE S+6+7*I,17:SU(I)=1:R(I)=1
350 POKE S+4+7*I,64:G(I)=-1:V$(I)="S0"
360 POKE S+7*I,0:POKE S+1+7*I,0
365 POKE S+7*I+2,0:POKE S+7*I+3,0:PW(I)=0
370 O(I)=0:F(I)=0:N$(I)=""
380 N(I)=-1:M(I)=1
390 NEXT I:V=0:P$=""
400 PRINT"■■■
```

```
660 IF A$="7" THEN POKE S+7*V+4,64:G(V)=-1:V$(V)="SQ":GOTO 1000
670 IF A$="8" THEN POKE S+7*V+4,32:G(V)=-1:V$(V)="ST":GOTO 1000
680 IF A$="9" THEN POKE S+7*V+4,16:G(V)=-1:V$(V)="T":GOTO 1000
690 IF A$="Z" OR A$="X" OR A$="C" OR A$="V" THEN 3000
700 IF A$=CHR$(13) THEN G(V)=-G(V):GOTO 4000
710 IF A$="■" THEN O(V)=0:GOTO 990
720 IF A$="■" THEN O(V)=1:GOTO 990
730 IF A$="■" THEN O(V)=2:GOTO 990
735 IF A$="■" THEN O(V)=3:GOTO 990
740 IF A$="■" THEN O(V)=4:GOTO 990
750 IF A$="■" THEN O(V)=5:GOTO 990
760 IF A$="■" THEN O(V)=6:GOTO 990
770 IF A$="■" THEN O(V)=7:GOTO 990
780 IF A$="P" THEN 6000
790 GOTO 400
990 M(V)=2↑O(V)
1000 REM PLAY NOTE
1010 IF N(V)<>-1 THEN 1040
1020 POKE S+7*V,0:POKE S+7*V+1,0
1025 F(V)=0
1030 GOTO 400
1040 F(V)=K(N(V))*M(V)
1045 IF F(V)>2↑16-1 THEN 1200
1050 F1=INT(F(V)/256):F2=F(V)-INT(F(V)/256)*256
1060 POKE S+7*V,F2:POKE S+7*V+1,F1
1070 GOTO 400
1200 PRINT"■THAT VALUE IS OUT OF RANGE■"
1210 T1=TI
1220 IF TI-T1<200 THEN 1220
1230 PRINT"┐                                    ┌"
1240 N(V)=-1:N$(V)="":O(V)=0
1250 GOTO 990
2000 FOR I=0 TO 1
2010 POKE S+I,0
2020 POKE S+I+7,0
2030 POKE S+I+14,0
2040 NEXT I
2050 GOTO 1000
3000 PRINT"■HIT SPACE OR DEL■"
3005 GET B$:IF B$=""THEN 3005
3006 PRINT"┐                    ┌"
3010 IF B$=" " THEN C=1:GOTO 3040
3020 IF B$=CHR$(20) THEN C=-1:GOTO 3040
3030 GOTO 3000
3040 IF A$="Z" AND A(V)<15 AND C=1 THEN A(V)=A(V)+1:GOTO 3100
3045 IF A$="Z" AND A(V)>0 AND C=-1 THEN A(V)=A(V)-1:GOTO 3100
3050 IF A$="X" AND D(V)<15 AND C=1 THEN D(V)=D(V)+1:GOTO 3100
3055 IF A$="X" AND D(V)>0 AND C=-1 THEN D(V)=D(V)-1:GOTO 3100
3060 IF A$="C" AND SU(V)<15 AND C=1 THEN SU(V)=SU(V)+1:GOTO 3200
3065 IF A$="C" AND SU(V)>0 AND C=-1 THEN SU(V)=SU(V)-1:GOTO 3200
3070 IF A$="V" AND R(V)<15 AND C=1 THEN R(V)=R(V)+1:GOTO 3200
3075 IF A$="V" AND R(V)>0 AND C=-1 THEN R(V)=R(V)-1:GOTO 3200
3080 GOTO 1000
3100 POKE S+7*V+5,16*A(V)+D(V):GOTO 1000
3200 POKE S+7*V+6,16*SU(V)+R(V):GOTO 1000
4000 IF G(V)=1 THEN Z=1:GOTO 4020
4010 Z=0
4020 IF V$(V)="N" THEN Z=Z+128
4030 IF V$(V)="SQ" THEN Z=Z+64
4040 IF V$(V)="ST" THEN Z=Z+32
4050 IF V$(V)="T" THEN Z=Z+16
4060 POKE S+7*V+4,Z
4070 GOTO 1000
5000 PRINT"■■■■■■■■■■■■■■■■VOICE #   FREQ(HZ)  WAVEFORM  GATE"
5005 PRINT"                                          ┌"
```

```
5010 PRINTV;TAB(9);INT(F(V)*.059655);TAB(20);V$(V)
5020 PRINT"■ATTACK    DECAY     SUSTAIN   RELEASE"
5030 PRINT"                                    ■"
5040 PRINTA(V);TAB(10);D(V);TAB(20);SU(V);TAB(30);R(V)
5050 PRINT"■NOTE";TAB(10);"OCTAVE #";TAB(20);"PULSE WIDTH"
5055 PRINT"                                    ■"
5060 PRINT" ";N$(V);TAB(10);O(V);TAB(20);PW(V)
5070 RETURN
6000 PRINT"■■■
```

Classified

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16K VIC20 + casette disc drive + Joystick, software including Program Aid, Super Expander, Sargon Chess + program ref. guide. Worth £650, sell for £400 ono. Tel: Shoeburyness 3984.

VIC20 CASSETTE UNIT. Joysticks, all boxed, TV set (b/w). Games, application, manual, magazines, £249 ono or for MZ80K. Tel: Colne 866386.

VIC20, + cassette deck, 3K high res. cartridge. Jelly Monsters, Space Battle, Joystick, £185 ono. Tel: 01-398 7033/1199, Mr Bredge.

VIC20 + cassette + four games + chess program. Learn basic + reference manual, £165. Tel: 061-434 8483.

VIC20, cassette deck, 3K super expander, high res. cartridge, joystick + £70 software, perfect condition, £190. Tel: Simon, Olton (0420) 85395.

COMMODORE VIC20, 8K, 3K super expander, machine monitor + 20 games, good condition, will separate. Tel: Norwich (0603) 712320 (5 pm).

VIC20 plus cassette unit, 8K expansion, intro to Basic Part 1, programs + magazines, still under guarantee, £195. Tel: 0993 844437.

VIC20 + cassette + joystick, introduction to Basic Parts 1 and 2. Progs. Reference Guide, three months old. £140. Tel: 01-908 4911.

VIC20, cassette deck, joystick, 16K Ram, few programs £220 ono. Tel: Dublin 01-723 5816. Ask for Mr Tyson.

VIC 20 + cassette unit, Afron expansion, 27K extra Ram, £75 books, £125 cartridges, £100 cassettes, as new. Sell for £525 (complete). Tel: 01-942 6324.

CBM PET 2001. 16K, new Rom, Cassette unit, program sounds generator, toolkit, manuals, software, good condition, £250 ono. Tel: Leek (0538) 385908.

COMMODORE PET 4032 (upgraded 3032) including 2 Rom sets, cassette, books, light pen, reset switch, (software tape or disc), £375. Tel: 0302 383212, 0793 830248.

32K PET, 3K Rom, disco pro chip, cassette player. Tel: 01-398 6963 (after 6.30 pm).

PET 3032 + 3040 dual disc unit (April '82) £975. Tel: Keith, Camberley (0276) 61484.

VIC20 with CZN cassette deck, 3K super expander, joysticks, Star Battle cartridge, Vic Revealed, lots of software, £150. Tel: Coalville 38611.

VIC20 cassette deck, Jelly monsters, 8K Ram, joystick. Superworm, Hopper, Alien Blitz, Amok, Mars Invaders, Ant Raiders, Another Vic in the Wall, Asteroids + 46 other games, worth £330. Offers. Tel: Great Dunmow 810720.

VIC20 + CZN cassette deck, integer basic part 1. £50 software. £160 ono. Tel: Ickford 887.

VIC20 plus 16K with cassette unit, Introduction to Basic 1 & 2, various games, all less than 3 months old. £220 ono. Tel: Sheffield (0742) 682155 evenings.

VIC20 + data cassette, 8K Ram, joystick + lots of cassette games, £140 ono. Tel: 01-948 3916 Andy.

VIC20 + cassette unit + joystick, Duplicated Prison, all boxed as new, £150. Tel: Evenings Hornchurch, Essex 44238 after 6 pm.

VIC 20 + cassette unit with 8K Ram, super expander, cartridges including Omega Race and Star Battle – also 10 cassette programs including Defender, Traxx and Frogger. Two months old, cost £360. Sell for £260 ono. Tel: 01-574 4122 after 4 pm.

VIC20 + cassette and 4-month guarantee, super expanded. Jelly Monster, Sargon Chess. Joystick + £30 software. Programme reference guide + more books, £170 ono. Tel: 0532-524657.

VIC20, plus 16K expansion, high res, tool kit, data set and £70 software. Will swap for BBC micro. Tel: 021-704 3915.

VIC20 with cassette deck, super expander, Alien, Voodoo Castle and Blitz. £180 ono. Tel: Spennymoor 817304, after 4.30 pm.

VIC20 + cassette, super expander, Jelly monsters, Lunar Lander, games and tapes, magazines, all boxed, under guarantee. £180 ono. Tel: 0384 75387.

VIC20 + casette deck + super expander 8K Ram. Sargon II Program Reserve Guide, Intro to Basic Part I, etc., £200. Tel: 041-948 6868.

VIC20 + cassette unit + 16K Ram + super expander + m/c monitor + Vic Revealed + programmers reference guide + light pen + £100 of software, 4 months old £350. Tel: Irving 213303 6–9 pm.

COMMODORE PET 32K, basic four toolkit, reset switch, cassette deck and cassettes + manuals, £375 ono. Tel: 01-748 9064 evenings.

19½K VIC20 cassette recorder, Adventure Rom, joystick, 32 programs, £200. Tel: Crawley 272434.

COMMODORE 8K, small keyboard integral cassette, £125 ono + small Trendoom Thermal Printer, 40 coles, £50 or £150 for both. Tel: 01-748 9064 evenings.

VIC20 16K + cassette unit, joystick, covers "O" level cassettes. £100 software, £230 ono. Tel: 021-458 7682.

VIC20 + CTN unit + super expander, Star Battle. Loads of software, magazines + Vic Revealed, £250. Tel: Chorley 64461.

VIC20 + 3K, data cassette, joystick, super expander. Adventures, Ratrace, Star Battle, Omega + 10 cassettes + mags, £300. Tel: Tatsfield 656.

COMMODORE PET 3032 with 2 disc drives and Commodore printer, 18 months old £1,500. Tel: Maidenhead (0628) 31961 evenings and weekends.

VIC20, cassette deck, lots of magazines, books and software for £150. Write only to Sid Akhlar, 1 Edward Street, Werneth, Oldham, Lancs OL9 7QW. Tel: 061-633 4887.

VIC20 + cassette, light pen, 32K. Various software, £200. Tel: 01-789 6183.

VIC20 plus cassette unit, plus 8K motherboard plus 3K super expander, Forth Rom, Gorf, Omega base, Saigon II, Chess and Star Battle cartridges, one joystick, various books and tapes £250 ono. Tel: Dunfermline (0383) 734731 evenings.

VIC20 + cassette recorder + Omega race + Vic Men cartridge £130. Tel: 061-773 4527.

VIC20, cassette, manuals, several issues of Vic computing 3 slot motherboard, 8K Ram expansion with battery back-up, machine code monitor cartridge, joystick, books on Basic and machine code programming, over £300 worth of software including Sargon II, Chess, Jelly Monsters, Super Lander. The whole lot is worth over £650, will sell for £400 ono. Tel: Terry Wilson on Preston (0772) 863638.

VIC20, cassette recorder, 3K super expander cartridge, joystick, PacMan cartridge, £60 of cassette software, two books, £250. Tel: 01-866 5135 evenings.

VIC20 + cassette with 3K super expander and 8L motherboard. The Count, Radar Ratrace, Mastermind, Intro to Basic 1, Vic revealed and other books + lots of software, under guarantee and boxed, £250. Tel: 952 4397.

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A complete nominal ledger system for accountants

Part 3: Update program

The editors of *Commodore Computing International* have developed a series of computer systems for accountants, for use with the Commodore 4000 with disk drive and printer.

The nominal ledger package contains programs for entry, sort, update, print, amend descriptions and filesort. The first two appeared in the February and March issues.

With the update program that follows, the transaction records will be merged with the B/F records on the nominal ledger file to create an updated file. At the end of the run the following controls will be printed on the brought forward file, transaction file and carried forward file:

— Total number of records.
— Total value.

```
10 REM ******************************
20 REM *** C O M P U T A B I T S ***
25 REM *** NOMINAL LEDGER SYSTEM ***
30 REM ******************************
40 REM
50 REM THIS PROGRAM UPDATES THE
60 REM NOMINAL LEDGER FILE WITH
70 REM        NEW DATA
80 REM
90 REM *** OPEN INPUT FILE ***
100 REM
110 OPEN2,8,2,"1:NOMINALSORTED,SEQ,READ"
120 IFST>0THEN14000
130 REM
140 REM *** OPEN B/F NOM LEDGER ***
150 REM
160 OPEN3,8,3,"1:NOMINALLEDGER,SEQ,READ"
170 IFST>0THEN14000
180 REM
190 REM *** OPEN C/F NOM LEDGER ***
192 REM
194 OPEN4,8,4,"@1:NOMINALDUMMY,SEQ,WRITE"
196 IFST>0THEN14000
202 REM
203 REM *** OPEN PRINT FILE ***
204 REM
205 OPEN5,4
206 IFST>0THENMESS$="UNABLE TO OPEN PRINT FILE":GOTO13000
210 REM
220 REM *** INITIALISE CONTROL TOTS ***
230 REM
240 BMB=0:BNET=0
250 TMB=0:TNET=0
260 CMB=0:CNET=0
265 PRINT"■■NOMINAL LEDGER UPDATE PROGRAM"
270 REM
280 REM *** READ TRANSACTION***
290 REM
300 GOSUB13000
310 REM
```

```
320 REM *** READ B/F ***
330 REM
340 GOSUB11000
350 REM
360 REM *** END OF UPDATE REACHED ? ***
370 REM
380 IFLEFT$(BREC$,3)="ZZZ"ANDLEFT$(TREC$,3)="ZZZ"THEN600
390 REM
400 REM *** COMPARE B/F <> TRANS ***
410 REM
420 IFLEFT$(BREC$,16)<LEFT$(TREC$,16)THEN480
430 REM
440 REM *** TRANS < B/F - INSERT ***
442 REM
450 PRINT#4,TREC$;CHR$(13);
451 IFST>0THEN14000
460 CMB=CMB+1
470 CNET=CNET+VAL(MID$(TREC$,21,10))
472 GOSUB10000
474 GOTO380
480 REM
490 REM *** B/F < TRANS - CARRY FWD ***
500 REM
510 PRINT#4,BREC$;CHR$(13);
520 IFST>0THEN14000
560 CMB=CMB+1
570 CNET=CNET+VAL(MID$(BREC$,21,10))
580 GOSUB11000
590 GOTO380
600 REM
610 REM *** END OF UPDATE ***
620 REM
625 PRINT#4,"ZZZZZZZZZZZZZZZZZZZZZ";CHR$(13);
630 CLOSE4
640 IFST>0THEN14000
642 REM
643 REM *** DISPLAY CONTROLS ***
644 REM
650 PRINT"■NOMINAL LEDGER UPDATE"
660 PRINT"■■BROUGHT FORWARD RECORDS ";BMB
670 PRINT"■BROUGHT FORWARD NET VALUE ";BNET
680 PRINT"■■TRANSACTION RECORDS ";TMB
690 PRINT"■TRANSACTION VALUE ";TNET
700 PRINT"■■CARRIED FORWARD RECORDS ";CMB
710 PRINT"■CARRIED FORWARD NET VALUE";CNET
720 DISC=BMB+TMB-CMB
730 IFDISC>0THENPRINT"■■■WARNING RECORD DISCREPENCY■";DISC
740 DISC=ABS(BNET+TNET-CNET)
745 IFDISC>.01THENPRINT"■■■WARNING VALUE DISCREPENCY■";DISC
747 REM
748 REM *** PRINT CONTROLS ***
749 REM
750 PRINT#5,"NOMINAL LEDGER UPDATE"
760 PRINT#5,"BROUGHT FORWARD RECORDS ";BMB
770 PRINT#5,"BROUGHT FORWARD NET VALUE ";BNET
780 PRINT#5,"TRANSACTION RECORDS ";TMB
790 PRINT#5,"TRANSACTION VALUE ";TNET
800 PRINT#5,"CARRIED FORWARD RECORDS ";CMB
810 PRINT#5,"CARRIED FORWARD NET VALUE";CNET
820 DISC=BMB+TMB-CMB
830 IFDISC>0THENPRINT#5,"WARNING RECORD DISCREPENCY";DISC
840 DISC=ABS(BNET+TNET-CNET)
845 IFDISC>.01THENPRINT#5,"WARNING VALUE DISCREPENCY";DISC
850 REM
```

```
860 REM *** CHECK UPDATE O.K. ***
870 REM
880 PRINT"IF UPDATE IS O.K. "
890 PRINT"ENTER C TO CONTINUE ";
900 GETA$:IFA$=""THEN900
910 IFA$="C"THEN1020
920 INPUT"■DO YOU WISH TO CANCEL THE UPDATE  *";
930 IFA$<>"Y"THEN880
940 REM
950 REM *** SCRATCH OUTPUT NOMLEDG ***
955 REM
960 OPEN1,8,15
970 IFST>0THEN14000
980 PRINT#1,"S1,NOMINALDUMMY"
985 IFST>0THEN14000
990 CLOSE1
1000 IFST>0THEN14000
1010 GOTO1150
1020 REM
1025 REM *** SCRATCH INPUT FILES ***
1030 REM *** RENAME OUTPUT NOMLEDG ***
1040 REM
1050 OPEN1,8,15
1060 IFST>0THEN14000
1070 PRINT#1,"S1:NOMINALUNSORTED"
1072 PRINT#1,"S1:NOMINALSORTED"
1074 PRINT#1,"S1:NOMINALLEDGER"
1080 PRINT#1,"R1:NOMINALLEDGER=1:NOMINALDUMMY"
1090 IFST>0THEN14000
1100 CLOSE1
1105 IFST>0THEN14000
1110 CLOSE5
1120 REM
1130 REM *** END OF RUN ***
1140 REM
1150 POKE42,010:POKE43,36:CLR:LOAD"0:NOMINAL MENU",8
10000 REM
10005 REM *** READ TRANSACTION FILE ***
10010 REM
10020 IFLEFT$(TREC$,3)="ZZZ"THEN RETURN
10030 INPUT#2,TREC$
10040 IFLEFT$(TREC$,3)="ZZZ"THEN10080
10045 IFST>0THEN14000
10050 TMB=TMB+1
10060 TNET=TNET+VAL(MID$(TREC$,21,10))
10062 PRINT"■■■■■TRANSACTION RECORDS ";TMB
10070 RETURN
10080 REM
10090 REM *** END OF FILE ENCOUNTERED ***
10100 REM
10110 CLOSE2
10120 IFST>0THEN14000
10125 PRINT"■■■■■■END OF TRANSACTIONS"
10130 RETURN
11000 REM
11005 REM *** READ BROUGHT FWD FILE ***
11010 REM
11020 IFLEFT$(BREC$,3)="ZZZ"THEN RETURN
11030 INPUT#3,BREC$
11040 IFLEFT$(BREC$,3)="ZZZ"THEN11080
11050 BMB=BMB+1
11060 BNET=BNET+VAL(MID$(BREC$,21,10))
11065 PRINT"■■■■■■■■BROUGHT FORWARD RECORDS ";BMB
11070 RETURN
```

```
!1080 REM
!1090 REM *** END OF FILE ENCOUNTERED ***
!1100 REM
!1110 CLOSE3
!1120 IFST>0THEN14000
!1125 PRINT"       END OF BROUGHT FORWARD FILE"
!1130 RETURN
!3000 REM
!3004 REM *** FATAL ERROR ***
!3006 REM
!3010 PRINT"              FATAL ERROR ";MESS$
!3020 SET9$:IFA$=""THEN13020
!3030 STOP
!4000 REM
!4010 REM *** DISC ERROR ***
!4020 REM
!4025 CLOSE1
!4030 OPEN1,8,15
!4040 INPUT#1,A$,B$,C$,D$
!4045 IF9$="00"THENRETURN
!4050 PRINT"              DISC ERROR "
!4060 PRINTA$;" ";B$;" ";C$;D$
!4070 SET9$:IFA$=""THEN14070
!4080 STOP
READY.
```


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Novel approach to problem solving

Title:	*Problem Solving in Basic.*
Price:	*£4.95.*
Author:	*Hugh Vincent.*
Publisher:	*Addison-Wesley.*
Address:	*53 Bedford Square, London WC1B 3BR.*
Tel:	*01-631 1636.*

I would have liked to devote this review to a book on the Commodore 64, but there are none to hand. Raeto West et al are beavering away on a VIC and 64 equivalent of their successful *Programming the PET/CBM*, but until then . . .

We start with *Problem Solving in Basic*, by Hugh Vincent, for anyone who programs in Basic on any Commodore machine.

Some of you may recall the series called Basic Basic, which one of the major general monthlies ran a few years ago. Consisting of hand-printed text (as opposed to typewriter copy), it was a friendly and humorous introduction to Basic programming.

Hugh Vincent has taken the same sort of idea and turned it into a Commodore-specific Basic programming aid, but concentrating on learning to program by solving problems.

Short programs

All the Basic keywords are introduced as the pages go by, with accompanying short programs to illustrate some facet of their use. For instance, RND is followed by a chapter of programs that demonstrate the concept of producing random numbers and then using those numbers to simulate (for example) a game of tennis.

As the games become more complex (we are playing golf shortly afterwards) more keywords are introduced, until we end up with a fairly complicated listing.

It is mainly games listings that are used to prove the point, but even if you're not a games fan the book should be useful if you're a newcomer to programming.

Most of the chapters are divided into studies and problems, with program development projects suggested at the end. Some are explained in the book, others are left to your own ingenuity.

Most of these projects are worthwhile, but a few could have been more carefully thought out; they may lead to faulty programming techniques.

If you're a novice programmer and want a different and interesting approach to learning how to write programs, you could do worse than take a look at this. If you're already fairly competent in Basic, you may prefer something more advanced.

Complete guide to the VIC-20

Title:	*Mastering the VIC-20.*
Price:	*£5.95.*
Authors:	*Jones, Coley and Cole.*
Publisher:	*Ellis Horwood Ltd.*
Address:	*Cooper Street, Chichester, West Sussex PO19 1EB.*
Tel:	*0243-789942.*

This is surely the best book yet for the serious VIC-20 programmer. At only £5.95 it's a must for anyone who wants to do anything more than insert cartridges in the back of the VIC.

It does assume some prior knowledge; indeed, it would be impossible to read the book without it. VIC Basic programming is covered in 15 pages; a great deal is crammed into that short space, followed by 10 pages on 'special effects' that can be achieved on the VIC.

After this relatively gentle introduction the authors take on memory maps and alternate screens and consider the 6561 control registers (or 6560 for our friends across the pond) in some detail.

Throughout these early chapters you are continually fed with a rich diet of useful programs: how to renumber a listing, how to prevent a program being listed, moving the screen left, right, up and down, and more.

Most important

All the control registers of the 6561 are examined, with an example of what each one does; producing a 30 by 30 low resolution screen, for instance, using register 6. This is probably the most important of all, and its uses are given a thorough run-down in chapter 4.

User-defined graphics and multicolour modes are also covered in the fourth chapter, as well as high resolution graphics.

This is followed by a treatise on commonly encountered VIC peripherals, including the keyboard (an often overlooked peripheral), cassettes, disks, printers (with a screen dump routine, alas in Basic), joysticks and others.

A look at system architecture is followed by an introduction to machine code programming, complete with a full list of the 6502 instruction set.

Linking the PET to IEEE-488 peripherals

Nigel Richman

The handbook for the Commodore PET 2001-32N says that the output port is Commodore's implementation of the IEEE-488 information bus. As Hewlett-Packard invented the HP-IB (Hewlett-Packard Information Bus) which was generalised as the IEEE-488 Bus, it came as rather a surprise to find that the HP 9876A thermal graphics printer failed to list more than one line of a program before the system locked up. Turning the printer off brought PET back to the READY status.

Trying to run a program with printer output also caused problems if two PRINT # statements were close together.

I managed to overcome the second of these problems by putting a small time delay in a sub-routine which was called up before each PRINT # . The sub-routine was:

```
10000 FOR PP=1 to 15 :NEXT:RETURN
```

As the printer incorporates, among its many other features, automatic form-feed to avoid perforated text, it was also necessary to include an output line counter and a form-feed character sub-routine with a longer delay. All rather inelegant.

To list a program required another technique as follows:

1. Form a DATA file of the program on DISK (or TAPE)

i.e. For DISK

```
OPEN 2,8,4, ''1:PROGRAM NAME,S,W,''
CMD 2:LIST
PRINT # 2, :CLOSE 2
```

For TAPE

```
OPEN1,1,1, ''PROGRAM NAME''
CMD 1:LIST
PRINT # 1, :CLOSE 1
```

2. Then the program in Figure 1 has to be LOADed and RUN. As can be seen this program reads the data character by character and outputs the listing line by line — all rather slow and a waste of a printer capable of 480 characters per second.

So here we are with two IEEE-488 'compatible' devices which fail to interwork correctly. Why? Well, before discussing the cause and cure I think it would be useful to explain the handshake principle of the IEEE-488 Bus.

Of particular interest are four major lines to control the transfer of data and eight data lines. The control lines are:

ATN — Attention
NRFD — Not ready for data
DAV — Data valid
NDAC — Not data accepted

The IEEE—488 bus uses inverse logic, so HIGH (1) is FALSE and LOW (0) is TRUE. The handshake sequence employed for the transfer of information is:

(a) The ATN line is held low to indicate that the information being transmitted is control for the peripherals and not DATA (e.g. set device 4 to the listen mode) — if HIGH then the information is DATA.
(b) As each device that is listening to the bus for DATA becomes ready it sets the NRFD line HIGH (false-so ready for data). This line can be held LOW (i.e. true) by a single peripheral. This means that data is not put on the DATA lines until the slowest peripheral is ready.
(c) Once the NRFD line has gone HIGH the controller puts DATA on the DATA lines. (Again the inverse of the actual byte of information because of the inverse logic of the bus — i.e. 10101100 is transmitted as 01010011). After a time to let the DATA lines settle the DAV line is set LOW — i.e. DATA VALID.
(d) When the DAV line goes LOW the listening peripherals then set the NRFD LOW and then having successfully latched the DATA from the DATA lines set the NDAC lines HIGH (false — i.e. DATA ACCEPTED). Again the line can be kept LOW by one peripheral so that all listening devices on the bus receive the DATA before it is removed.
(e) After NDAC goes HIGH the DAV line is set HIGH (False — i.e. NOT DATA VALID) and the DATA lines are set to all ones (i.e. 11111111).
(f) The ATN line is used at the end of the information transfer to free the bus of listeners (or talkers).

All fairly simple. First of all you specify a device to listen and then you send it the DATA byte by byte. When the DATA transfer is complete you tell the

Nigel Richman is a transmission system development engineer with British Telecom, working on digital line systems. Supersoft have marketed a number of his machine code programs.

So here we are with two IEEE-488 compatible devices which fail to interwork correctly.

device to UNLISTEN.

So why didn't the PET interface with the printer when both are supposed to be IEEE-488 bus compatible? Two reasons really. One the PET and one the printer.

The PET has an inbuilt timer which is used to ensure that if the handshake takes too long the system does not lock up. What happens is that if a device on the IEEE-488 bus takes longer than 64mS to set the NDAC line HIGH after the DAV line goes LOW, then PET times-out on write, sets ST = 1 and goes on to the next operation. No time-out is specified in the IEEE-488 spec.

The H-P 9876A printer only has a single line buffer and therefore the DATA transfer rate is limited by the time taken by the carriage return-line feed (CR-LF) action, and as PET timed out this CR-LF obviously takes longer than 64mS. What the printer does is to set the NRFD line HIGH even though, because it is in the CR-LF phase of operation, it is *not* ready for data. The DATA transfer is then delayed by holding the NDAC line LOW until the printer is ready. This allows other peripherals in the listen mode to accept the DATA but does cause PET to time-out.

Two courses

So now we have the reason for the incompatibility, what can be done about it? There were two courses of action that could have been followed, modifying the printer, or modifying the PET.

Now since the printer cost more than £2000 I did not think that attacking its insides would be a very good idea. So PET — are you sitting comfortably?

The output to IEEE—488 bus routine in PET's operating system is given in Figure 2. This was located by means of Nick Hampshire's book *Pet Revealed* and Supersoft's 6502 Disassembler.

Figure 1: Program to list basic programs stored as ASCII data files

```
5 REM PROGRAM TO LIST ASCII FILE
10 REM BY NJ RICHMAN
15 REM
20 REM OPEN 2,8,4,"1:PROGNAME,S,W"
25 REM CMD 2:LIST:CLOSE 2
30 N=1
35 INPUT"ENTER NAME OF PROGRAM";PN$
40 FL$="1:"+PN$+",S,R"
45 OPEN 2,8,4,FL$
50 OPEN 3,4
55 GOSUB 120:PRINT#3,PN$
60 B$=""
65 GET#2,A$:IF A$="" THEN 65
70 IF A$=CHR$(10) THEN 65
75 IF A$=CHR$(13) THEN 85
80 B$=B$+A$:GOTO 65
85 IF ST=2 THEN GOSUB 135:CLOSE 2:CLOSE 3:END
90 IF VAL(B$)=0 THEN 60
95 IF LEN(B$)>80 THEN 155
100 GOSUB 120:PRINT#3,B$:N=N+1
105 IF N=65 THEN GOSUB 135
110 IF ST=64 THEN CLOSE 2:CLOSE 3:END
115 GOTO 60
120 FOR PP=1 TO 15 :REM DELAY
125 NEXT PP
130 RETURN
135 GOSUB 120:N=0:PRINT#3,CHR$(12);:REMEND OF PAGE SO SEND FORM FEED
140 FOR PP=1 TO 1000:REM LONG DELAY
145 NEXT PP
150 RETURN
155 GOSUB 120:PRINT#3,LEFT$(B$,75):REM LONG LINE IN TWO PARTS
160 GOSUB 120:PRINT#3,RIGHT$(B$,LEN(B$)-75)
165 N=N+1:GOTO 105
```

As shown the time-out is effected by the code between $F10D and $F11C. This looks for NDAC going HIGH but uses TIMER 1 of the VIA to limit the delay time to 64mS. As 64mS is generated by loading the high byte of the timer with $FF it is not possible to extend the time-out period within the ROM space available. So I modified the routine to that given in Figure 3 which causes PET to wait indefinitely for NDAC to go HIGH after DAV goes LOW.

Having copied the MOS 2332 masked ROM (with changes) into a Texas 2532 Eprom and inserted it in the left-hand ROM socket (UD9 by the edge of the board), the output to the printer was just perfect. Listings were directly available at high speed and no sub-routines were needed for PRINT # statements.

Not compatible

Finding the correct Eprom to use was a problem in itself. Commodore use MOS devices and the MOS 2332 ROM is not pin compatible with the Intel 2332 ROM. The MOS data sheet for their 2332 states that it is pin compatible with the 2732 Eprom. This, however, is not correct as the 2732 is an Intel device which is pin compatible with the Intel 2332 ROM. As I said before, the device to use is the Texas 2532 JL Eprom (5 volt rail).

Before I made the changes to the ROM I could not find out from anyone the purpose of the time-out. But without it I have occasionally had problems with system lock-out due to the NDAC line being held LOW by the disk. This mainly occurred when trying to SAVE a file with a name that already existed on disk. However since replacing a faulty Analog board in the disk unit I have had no lock-out problems.

If it is a problem there are four solutions:

(a) Turn off the PET and lose the program.
(b) Pull the IEEE-488 connector out of the disk unit.
(c) Fit and use a non-maskable interrupt push button.
(d) Use the modified routine shown in Figure 4 in place of the one in Figure 3. This routine checks to see if the SHIFT key has been pressed during the wait for the NDAC line going HIGH. Pressing the SHIFT key results in the normal TIME-OUT sequence (ST = 1).

Option (d) is probably the best solution to the problem ((a) only to be used in blind panic) but I would still recommend the addition of the NMI push button. It is able to revive PET from most system crashes provided the NMI vectors ($0094 and $0095) have not been altered. Also the program is not lost as can happen with a RESET button.

Detection of any key to cause a time-out may be in conflict with another use of that key. E.g. the SHIFT key is used by Wordcraft to initiate a document printout and if you are not quick on and off the SHIFT key a system lock-out can occur. Cured by option (b). To detect any other key to initiate a TIME-OUT the first two lines of Figure 3 would become:

LDA $97: last key pressed.
CMP #**: compare with PET value of desired key.
BEQ $F136: branch to TIME-OUT.

In order to provide an NMI facility a momentary type of push button should be connected to the memory expansion connector J4 pins 24 and 24A (new PETs only). Pin 1 is nearest the front of the PET. Pin 24 goes to the NMI input of the 6502 processor and pin 24A goes to earth. Mounting the push button is left to individual preference but I hid mine out of the reach of wandering fingers.

Although my experience is limited to a particular printer I feel sure that other peripherals with mechanical actions (e.g. X-Y plotters) could also suffer similar time-out problems and that the described ROM changes would be of great value. This view appears to have Commodore's support as they have provided Basic 4.0 with the ability to inhibit the time-out-on-write feature.

```
TIMEOUT.ED

F0EE ******     1 *          =$F0EE
F0EE ******     2 !COMMODORE PET ROUTINE FOR IEEE-488 BUS
F0EE ******     3 !
F0EE A93C       4            LDA #$3C          !SET DAV
F0F0 8D23E8     5            STA $E823         !HIGH.
F0F3 AD40E8     6            LDA $E840         !END IF BOTH
F0F6 2941       7            AND #$41          !NDAC AND NRFD
F0F8 C941       8            CMP #$41          !ARE HIGH AT THE
F0FA F041       9            BEQ $F13D         !SAME TIME.
F0FC A5A5      10            LDA $A5           !INVERT CHARACTER
```

```
F0FE 49FF     11            EOR ##$FF          !TO BE SENT.
F100 8D22E8   12            STA $E822          !STORE IN DATA LINES.
F103 2C40E8   13            BIT $E840          !TEST FOR NRFD HIGH
F106 50FB     14            BVC $F103          !LOOP IF LOW.
F108 A934     15            LDA ##$34          !SET DAV
F10A 8D23E8   16            STA $E823          !LOW.
F10D A9FF     17            LDA ##$FF          !LOAD TIMER 1 FOR
F10F 8D45E8   18            STA $E845          !64 MILLISECOND COUNT PERIOD.
F112 AD40E8   19            LDA $E840          !TEST FOR NDAC HIGH
F115 2C4DE8   20            BIT $E84D          !OR TIMER 1 INTERUPT.
F118 701C     21            BVS $F136          !TIME OUT ON WRITE IF V SET.
F11A 4A       22            LSR A              !LOOP BACK IF  NDAC
F11B 90F5     23            BCC $F112          !STILL LOW.
F11D A93C     24            LDA ##$3C          !SET DAV
F11F 8D23E8   25            STA $E823          !HIGH.
F122 A9FF     26            LDA ##$FF          !SET DATA LINES
F124 8D22E8   27            STA $E822          !HIGH.
F127 60       28            RTS
F128 ******   29 !
F128 ******   30 !FIGURE 2.
F128 ******   31 !
F128 ******   32 !
F128 ******   33 !
F128 ******   34 !
F128 ******   35 !MODIFIED PART OF IEEE-488
F128 ******   36 !ROUTINE TO PREVENT TIMEOUT.
F128 ******   37 !
F10D ******   38 *          =$F10D
F10D AD40E8   39            LDA $E840          !TEST FOR NDAC
F110 2901     40            AND ##$01          !HIGH.
F112 F0F9     41            BEQ $F10D          !LOOP BACK IF LOW.
F114 4C1DF1   42            JMP $F11D          !JUMP TO AVOID NO OPS.
F117 EA       43            NOP
F118 EA       44            NOP
F119 EA       45            NOP
F11A EA       46            NOP
F11B EA       47            NOP
F11C EA       48            NOP
F11D ******   49 !
F11D ******   50 !FIGURE 3.
F11D ******   51 !
F11D ******   52 !
F11D ******   53 !
F11D ******   54 !MODIFIED ROUTINE WITH
F11D ******   55 !SHIFT KEY DETECTION.
F11D ******   56 !
F10D ******   57 *          =$F10D
F10D A598     58            LDA $98            !TEST SHIFT KEY STATUS.
F10F D025     59            BNE $F136          !TIMEOUT IF PRESSED.
F111 AD40E8   60            LDA $E840          !TEST FOR NDAC
F114 2901     61            AND ##$01          !HIGH.
F116 F0F5     62            BEQ $F10D          !LOOP BACK IF LOW.
F118 ******   63 !
F118 ******   64 !FIGURE 4.
F118 ******   65             .END
```

Finding the missing word

Another collection of useful PET programs and utilities, kicking off with an educational program called School-Marm. This takes any sentence (inputted as a data statement in line 1000 and onwards: you're only limited by the memory of your machine) and gets the student to fill in the missing word or part of a word.

This is achieved by flanking the word you want the student to input with asterisks (*), as in line 1001 for example. Here the word CAPITAL is the one to fill in. The program performs all kinds of error checking routines before a correct answer appears.

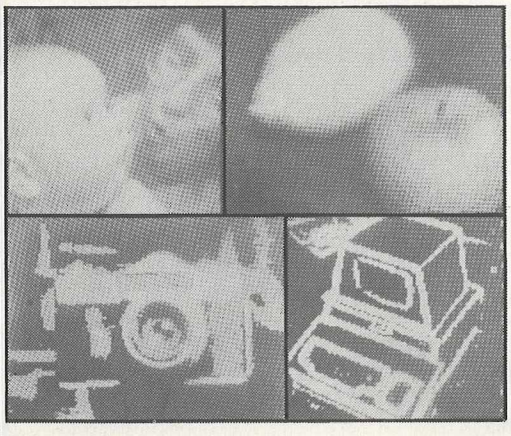
Thus, by using your own sentences, you can teach sentence structure, grammar, case endings, and many other techniques.

School-Marm — Steven Darnold — Universal

```
1 REM   ************************
2 REM   *                      *
3 REM   *     SCHOOL-MARM      *
4 REM   *                      *
5 REM   *          BY          *
6 REM   *                      *
7 REM   *    STEVEN DARNOLD    *
8 REM   *     P.O. BOX 201     *
9 REM   *    ALEXANDRA, N.Z.   *
10 REM  *                      *
11 REM  ************************
12 REM
100 READN:POKE59468,14:PRINT"■"
110 FORI=1TON:POKE850+I,0:NEXT
119 REM  *** READ LINE ***
120 FORI=1TON
130 IFPEEK(850+I)=2THENREADA$:NEXT:GOTO500
140 C=C+1:PRINTMID$(STR$(C),2)". ";
150 READA$
159 REM  *** WRITE LINE ***
160 FORJ=1TOLEN(A$)
170 IFMID$(A$,J,1)="*"THEN540
180 PRINTMID$(A$,J,1);
190 NEXT
199 REM  *** POSITION CURSOR ***
200 IFPEEK(198)>39THENPRINT"■■"
210 PRINT"■"
220 IFC>9THENT=1
230 IFC>99THENT=2
240 PRINTTAB(P+T+1)"■■";
250 B$=MID$(A$,P,L)
260 C$=""
269 REM  *** INPUT ANSWER ***
270 WAIT158,7:GETG$:G=ASC(G$)
280 IFG=20ANDC$<>""THENPRINT" ■■■■■";:C$=LEFT$(C$,LEN(C$)-1):GOTO270
290 IFG=13THEN340
300 IFG<32THEN270
310 IFG>90ANDG<193THEN270
320 C$=C$+G$:PRINTG$;:IFLEN(C$)=LTHEN340
330 PRINT"■■";:GOTO270
340 IFC$=B$THEN460
349 REM  *** WRONG ANSWER ROUTINE ***
350 POKE850+I,1
```

```
360 FORJ=1TOLEN(C$)
370 IFMID$(C$,J,1)<>MID$(B$,J,1)THEN390
380 NEXT
390 C$=LEFT$(B$,J)
400 IFPEEK(198)>39THENPRINT"□";
410 PRINT"□":PRINTTAB(P+T+J);MID$(B$,J,1);
420 IFLEN(C$)=LTHENPRINT:PRINT:PRINT:NEXTI:GOTO500
430 PRINT"_";:IFL-J>1THENFORK=JTOL-2:PRINT" ";:NEXT
440 FORK=JTOL-1:PRINT"■■":NEXT
450 GOTO270
459 REM  *** CORRECT ANSWER ROUTINE ***
460 PRINT:PRINT:PRINT
470 FORJ=1TO25
480 PRINT"CORRECT□":FORK=1TO25:NEXTK:PRINT"■CORRECT■□":FORK=1TO25:NEXTK
490 NEXTJ,I
499 REM  *** CHECK SCORE ***
500 FORI=1TON:J=PEEK(850+I)
510 IFJ=0THENPOKE850+I,2:S=S+1:IFN-S<2THENPRINT"■VERY■ ■GOOD■":END
520 IFJ=1THENPOKE850+I,0
530 NEXT:RESTORE:READI:GOTO120
539 REM  *** ASTERISK FILTER ***
540 L=0:P=J+1
550 J=J+1
560 IFMID$(A$,J,1)="*"THENNEXT
570 PRINT" ";:L=L+1:GOTO550
1000 DATA 3
1001 DATA "THE FACTORS OF PRODUCTION ARE LABOUR, *CAPITAL* AND LAND.
1002 DATA "JOY IS AN *ABSTRACT* NOUN.
1003 DATA "LES VACHES SONT BRUN*ES*.
READY.
```


THE FASTEST CCTV INTERFACE FOR YOUR PET OR CBM



The Ortholog Model 383 is the only system available which lets you collect CCTV camera images in one frame period (1/25 second), thereby letting you examine either moving or static images. It contains a 128-by-128 pixel, 6-bit data store: images can be transferred from the store to your Pet or CBM in 0.5 seconds. A comprehensive software package is provided which contains routines for displaying black/white images every 1.8 seconds, 5-level or 10-level images every 11 seconds or even 64-level images every 35 seconds for photographic recording. Screen images or data can be transferred to/from disc, and an edge-enhancement routine is also included (Note: your computer should be fitted with a Supersoft high-resolution board for the display options to be useable). The Model 383 costs only £850 all-inclusive: demonstrations can be arranged. For more information contact:

ORTHOLOG LTD., PO BOX 72, EDGWARE, MIDDLESEX HA8 6RD. TEL. 01.952.2459

Compactor — Robert Baker — Universal

This is a function that all of you will have seen before, but perhaps you have not been able to obtain the program. This compacts another program by removing all the REM statements and compressing lines wherever possible.

It is elegantly written and the heavy use of REM statements makes it easy to see what's going on. Perhaps the first program you ought to compact is itself!

You will need a disk drive for this one.

```
10 REM ****************************
20 REM *    C O M P A C T O R     *
30 REM *    ------------------    *
40 REM *    BY:  ROBERT BAKER     *
50 REM *                          *
60 REM *    BAKER ENTERPRISES     *
70 REM *     15 WINDSOR DR.       *
80 REM *    ATCO, N.J.  08004     *
90 REM ****************************
100 :
101 REM****************************
102 REM*  INSTRUCTIONS ADDED BY   *
103 REM*     JOHN EASTON FOR      *
104 REM*CHRISTIAN  COMPUTER/BASED*
105 REM*       COMMUNICATIONS     *
106 REM*       44 DELMA DRIVE     *
107 REM*TORONTO, ONTARIO  M8W 4N6*
108 REM****************************
109 :
110 CLR : DIM TL(1000)
120 :
130 REM *****************
140 REM READY DISK FILES
150 REM *****************
160 :
170 PRINT"■"SPC(14)"■ COMPACTOR ■■
172 PRINT"THIS PROGRAM WILL COMPACT A PROGRAM"
174 PRINT"LOCATED ON DRIVE #0 BY DELETING ALL REM"
176 PRINT"NOTATIONS, BLANK LINES, AND BY LINKING"
178 PRINT"TOGETHER ALL POSSIBLE LINES.■"
180 PRINT"THE NEW COMPACTED PROGRAM WILL BE SAVED"
182 PRINT"TO DISK DRIVE #1 WITH THE SAME FILENAME"
184 PRINT"BUT WITH A '/C' SUFFIX.■"
185 PRINT,"■■■└──────────────────────────
187 PRINT,"■■■■■ INPUT FILE IN  DRIVE #0 "
188 PRINT,"■■■■■OUTPUT FILE IN  DRIVE #1 "
190 PRINT,"■■■┌──────────────────────────────────■■"
200 INPUT"■INPUT FILE NAME■";FL$
210 PRINT"■SCANNING FILE
220 PRINT"   FOR TARGET LINES.....■■
230 OPEN 15,8,15:GOSUB 2370
240 OPEN 5,8,5,"0:"+FL$+",P,R"
250 :
260 REM ****************************
270 REM READ LOAD ADR, LINK & LINE#
280 REM ****************************
290 :
300 GOSUB 2370 : GOSUB 2310
310 GOSUB 2310 : IF V+V1=0 THEN 790
320 GOSUB 2310 : LN=V1+(256*V)
330 :
340 REM ********************************
350 REM         SCAN BASIC LINES
360 REM FOR GOTO, GOSUB, & THEN TOKENS
370 REM ********************************
380 :
390 GOSUB 2330
400 IF V=0 THEN 310
410 IF V=137 OR V=141 THEN 480
420 IF V<>167 THEN 390
```

```
430
440 REM *****************
450 REM GET TARGET LINE#
460 REM *****************
470 :
480 LT=0
490 GOSUB 2330 : IF V=32 THEN 490
500 IF V<48 OR V>57 THEN 580
510 LT=(10*LT)+VAL(C$)
520 GOSUB 2330 : GOTO 500
530 :
540 REM ************************
550 REM CHECK IF ALREADY FOUND
560 REM ************************
570 :
580 FOR X=0 TO N
590   IF TL(X)=LT THEN 710
600 NEXT X
610 TL(N)=LT : N=N+1
620 PRINT LT,
630 IF N<1000 THEN 710
640 PRINT"■■TOO MANY TARGET LINES!
650 GOTO 2430
660 :
670 REM ******************************
680 REM CHECK FOR 'ON...GOTO/GOSUB'
690 REM ******************************
700 :
710 IF V=44 THEN 480
720 IF V<>32 THEN 400
730 GOSUB 2330 : GOTO 710
740 :
750 REM ******************
760 REM SORT TARGET LINES
770 REM ******************
780 :
790 IF N<2 THEN 900
800 FOR X=0 TO N-1
810 :  FOR Y=0 TO N-2
820 :    IF TL(Y) < TL(X) THEN 840
830 :    V=TL(Y) : TL(Y)=TL(X) : TL(X)=V
840 NEXT Y,X
850 :
860 REM ***********************
870 REM GET READY FOR COMPACT
880 REM ***********************
890 :
900 PRINT "■COMPACTING LINES....■■
910 CLOSE 5
920 OPEN 5,8,5,"0:"+FL$+",P,R"
930 GOSUB 2370
940 FO$=LEFT$(FL$,14)+"/C"
950 PRINT#15,"S1:"+FO$
960 OPEN 6,8,6,"1:"+FO$+",P,W"
970 GOSUB 2370
980 :
990 REM  **************
1000 REM COPY LOAD ADR
1010 REM **************
1020 :
1030 GOSUB 2310
1040 PRINT#6,CHR$(V1);
1050 PRINT#6,CHR$(V); : R=0
1060 :
1070 REM ***************************
1080 REM COPY LINK AND LINE NUMBER
1090 REM ***************************
1100 :
1110 GOSUB 2310 : K1=V1 :K2=V
1120 F=0 :IF V+V1=0 THEN 2230
1130 GOSUB 2310 : L1=V1 : L2=V
1140 LN=L1+(256*L2) : PRINT LN,
1150 GOSUB 2330
1160 IF V=32 OR V=58 THEN 1150
1170 IF V=0 THEN 1200
1180 IF V<>143 THEN 1240
1190 GOSUB 2330 : IF V>0 THEN 1190
1200 F=1 : FOR X=0 TO N
1210 :  IF TL(X)<LN THEN NEXT X
1220 :  IF TL(X)=LN THEN 1240
1230 GOTO 1110
1240 PRINT#6,CHR$(K1);CHR$(K2);
1250 PRINT#6,CHR$(L1);CHR$(L2); : R=4
1260 :  IF F THEN PRINT#6,":"; : R=5
1270 F=0 : GOTO 1360
1280 :
1290 REM ****************************
1300 REM ****  SCAN BASIC LINE  ****
1310 REM **** & COMPACT PROGRAM ****
1320 REM ****************************
1330 :
1340 PRINT#6,C$; : R=R+1
1350 GOSUB 2330
1360 :  IF V=137 THEN F=1
1370 :  IF V=139 OR V=167 THEN F=1
1380 :  IF V=0 THEN 1820
1390 :  IF V=32 THEN 1350
1400 :
1410 REM ********************
1420 REM 'REM' TOKEN -
1430 REM DISCARD REST OF LINE
1440 REM ********************
1450 :
1460 IF V<>143 THEN 1550
1470 GOSUB 2330 : IF V>0 THEN 1470
1480 GOTO 1820
1490 :
1500 REM ****************************
1510 REM QUOTE -
1520 REM COPY TILL NEXT OR LINE END
1530 REM ****************************
1540 :
1550 IF V<>34 THEN 1690
1560 PRINT#6,C$; : R=R+1
1570 GOSUB 2330
1580 IF V=34 THEN 1340
1590 IF V>0 THEN 1560
1600 IF F THEN V=0 : GOTO 1050
1610 PRINT#6,CHR$(34); : R=R+1
1620 GOTO 1820
1630 :
1640 REM ************************
1650 REM IF COLON - CHK NEXT CHAR
1660 REM       ELSE COPY CHAR
1670 REM ************************
1680 :
1690 IF V<>58 THEN 1340
1700 GOSUB 2330
1710 IF V=32 OR V=58 THEN 1700
1720 IF V=143 THEN 1470
1730 IF V=0 THEN 1820
1740 PRINT#6,":"; : R=R+1
1750 GOTO 1360
1760 :
1770 REM ******************************
1780 REM END OF LINE -
1790 REM CAN WE COMPACT THESE LINES ?
1800 REM ******************************
1810 :
1820 IF F OR (R>170) THEN V=0:GOTO 1050
```

```
1830 GOSUB 2310
1840 IF V+V1=0 THEN 2230
1850 GOSUB 2310 : LN=V1+(256*V)
1860 L1=V1 : L2=V : PRINT LN,
1870 :
1880 REM ************************
1890 REM CHK IF LINE# IS A TARGET
1900 REM ************************
1910 :
1920 FOR X=0 TO N
1930 IF TL(X)<LN THEN NEXT X
1940 IF TL(X)=LN THEN 2110
1950 :
1960 REM ********************
1970 REM NOT USED -
1980 REM DISCARD LINK & LINE#
1990 REM ********************
2000 :
2010 GOSUB 2330 : IF V=143 THEN 1470
2020 IF V=32 OR V=58 THEN 2010
2030 IF V=0 THEN 1830
2040 PRINT#6,":"; : R=R+1 : GOTO 1360
2050 :
2060 REM ******************************
2070 REM LINE# NEEDED -
2080 REM WRITE LINE END, LINK & LINE#
2090 REM ******************************
2100 :
2110 PRINT#6,CHR$(0);CHR$(1);CHR$(1);
2120 PRINT#6,CHR$(L1);CHR$(L2); : R=4
2130 GOSUB 2330
2140 IF V=32 OR V=58 THEN 2130
2150 IF V=0 OR V=143 THEN PRINT#6,":";
2160 F=0 : GOTO 1360
2170 :
2180 REM ********************
2190 REM END OF COMPACT -
2200 REM WRITE END OF PROGRAM
2210 REM ********************
2220 :
2230 PRINT#6,CHR$(0);CHR$(0);CHR$(0);
2240 PRINT"■■■■■DONE■■"
2242 PRINT"NOW LOAD THE NEW PROGRAM FROM DRIVE #1.■■"
2243 PRINT"AS IT SITS NOW,THE PROGRAM POINTERS ARE"
2244 PRINT"ALL SHOOK UP > RE/SET THE PROGRAM LINKS"
2245 PRINTTAB(15)"──────────────────────"
2246 PRINT"■ RE-LINK ■ THE LINES BY ENTERING A ■ CLR ■"
2247 PRINT"COMMAND  BEFORE RUNNING OR SAVING PROG.■■"
2248 PRINT"THEN   RE-SAVE THE PROGRAM WHEREVER YOU";TAB(55)"DESIRE !"
2250 GOTO 2430
2260 :
2270 REM ************************
2280 REM *****  SUBROUTINES *****
2290 REM ************************
2300 :
2310 GOSUB 2330 : V1=V
2320 :
2330 GET#5,C$ : GOSUB 2370
2340 IF C$="" THEN V=0 : RETURN
2350 V=ASC(C$) : RETURN
2360 :
2370 INPUT#15,EN,EM$,ET,ES
2380 IF EN=0 THEN RETURN
2390 :
2400 PRINT : PRINT"■■■■DISK ERROR■"
2410 PRINT EN;EM$;ET;ES
2420 :
2430 CLOSE 5 : CLOSE 6 : CLOSE 15
2440 END
READY.
```

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Diskmon: extending the PET machine code monitor

This month we give you 23 extra commands for the PET's own internal monitor, making the writing and debugging of machine code programs much easier, and giving the user of disk drives some powerful extra facilities.

This is for Basic 4 only, and the disk program only works with 8050s.

Extradiskmon, to give the program its full title, is the merging of two other programs. Extramon, which is available freely (and is on the Commodore Assembler disk if you have one of those), is just an extension to the original monitor. Commands like disassemble, fill, new locate and so on, are the features to be found here.

Diskmon is something that you won't be able to find so easily, and adds an additional 11 commands over and above Extramon. These (with one exception) are all for use with disk drives, allowing you to read and write to sectors, set and put blocks, display 8050 memory, and more besides. The exception is simply a help command.

The beauty of having these two programs merged is that they can be used concurrently. A look at the command examples given later in this article will give you some idea of what we mean.

Even if you don't do any machine code programming, it is worth typing this in. It represents the ideal starting point for the beginner, and will make machine code life seem a lot more simple than it used to.

The commands

To give you just a brief idea of the power of Extradiskmon (we'll call it Diskmon from now on: it's easier), here is a list of the commands at your disposal.

We apologise to those of you who are already familiar with some of them, but bear with us: we'll make it worth your while in the end.

EXTRADISKMON

COMMANDS - USER INPUT IN [illegible]

SIMPLE ASSEMBLER

```
.A  2000 A9 12    LDA #$12
.A  2002 9D 00 80 STA $8000,X
.A  2005 [illegible]GARBAGE
```

In the above example the user started assembly at 2000 hex. The first instruction was load a register with immediate 12 hex. In the second line the user did not need to type the 'A' and address. The simple assembler retyped the last entered line and prompts with the next address. To exit the assembler type a return after the address prompt. Syntax is the same as the disassembler output. A ':' can be used to terminate a line.

BREAK SET

```
.[illegible]
```

The example sets a break at 1000 hex on the FF hex occurence of the instruction at 1000. Break set is used with the quick trace command. A break set with count blank stops at the first occurence of the break address.

DISASSEMBLER

```
.D [xxxx]
.;  2000 A9 12    LDA #$12
.;  2002 9D 00 80 STA $8000,X
.;  2005 AA       TAX
```

Disassembles to the end of memory starting at 1000 hex. The three bytes following the address may be modified. Use the crsr keys to move and modify the bytes. Hit return and the bytes in memory will be changed. EXTRAMON will then disassemble that line again.

```
.D [xxxx] [xxxx]
```

Disassembles from 2000 to 3000.

ENABLE STOP

```
.E
```

Allows an exit from machine programs. If keyboard interrupts are still operating the program maybe stopped by pressing the stop and '=' keys at the same time.

FILL MEMORY

```
.F [xxxx] [xxxx] xx
```

Fills the memory from 1000 hex to 1100 hex with the byte FF hex.

GO RUN

```
.G
```

Go to the address in the PC register display and begin run code. All the registers will be replaced with the displayed values.

```
.G [xxxx]
```

Go to address 1000 hex and begin running code.

HUNT MEMORY

```
.H [xxxx] [xxxx] "xxxx"
```

Hunt thru memory from C000 hex to D000 hex for the ascii string "READ" and print the address where it is found. A maximum of 32 characters may be used.

```
.H [xxxx] [xxxx] xx xx xx
```

Hunt memory from C000 hex to D000 hex for the sequence of bytes "20 D2 FF" and print the address. A maximum of 32 bytes may be used. Hunt can be stopped with the stop key.

INTEGRATE MEMORY

```
.M [xxxx]

.; F000 54 4F 4F 20 4D 41 4E 59[xxxxxxxx]
.; F008 20 46 49 4C 45 D3 46 49[xxxxxxxx]
```

Displays hex and ascii until the end of memory

```
.M [xxxx] [xxxx]
```

Displays hex and ascii from F000 hex to F080 hex.

LOAD FROM TAPE

```
.L
```

Load any program from cassette #1.

```
.L "RAM TEST"
```

Load from cassette #1 the program named "RAM TEST".

```
.L "RAM TEST",8,2
```

Load from cassette #2 the program named "RAM TEST".

Beware load with a file name breaks the link saved by the monitor. Do not use go command after load. Exit to basic and re-enter monitor.

MEMORY DISPLAY

```
.M 0000 0080

.:  0000 00 01 02 03 04 05 06 07
.:  0080 08 09 0A 0B 0C 0D 0E 0F
```

Display memory from 0000 hex to 0080 hex. The bytes following the address may be modified by editing and then typing a return.

NEW LOCATER

```
.N 7000 77FF 1000 0400 8000

.N 7000 77FF 1000 0400 8000 W
```

Relocates machine code from 7000 hex to 77FF hex to a new location at 1000 hex. New locater fixes all 3 byte instructions in the range 0400 hex to 8000 hex. The 'W' option will relocate .word tables only. New locater will not move instructions of 00. Transfer the tables first then zero tables in the from copy. New locater stops and disassembles on a bad op code.

QUICK TRACE

```
.T                              .T 1000
```

The first example begins trace at the address in the pc of the register display, the second begins at 1000 hex. Each instruction is executed as in the walk command but no disassembly is shown. The break address is checked for the break on nth occurence. The execution may be stopped by pressing the stop and '=' keys at the same time.

REGISTER DISPLAY

```
.R

PC  SR AC XR YR SP
.;  0000 01 02 03 04 05
```

Displays the register values saved when EXTRAMON was entered. The values may be changed with the edit followed by a return.

Use this instruction to set up the pc value before single stepping with .T

SAVE TO TAPE

.S [illegible]

Save to cassette #1 memory from 0800 hex up to but not including 0C80 hex and name it "PROGRAM NAME".

Beware save with a file name breaks the irq saved by the monitor. Do not use go command after save. Exit to basic and re-enter monitor.

TRANSFER MEMORY

.T [illegible] [illegible] [illegible]

Transfer memory in the range 1000 hex to 1100 hex and start storing it at address 5000 hex.

UNDO STOP KEYS

.U

Disables exit from machine language programs with the stop and '=' keys.

WALK CODE

.W

Single step starting at address in register pc.

.W [illegible]

Single step starting at address 1000 hex. Walk will cause a single step to execute and will disassemble the next instruction.

Control speed with choice of key:

[illegible] for single step;
[illegible] for slow step;
[illegible] for fast stepping.

BLOCK TRANSFER 8050 --> CBM

.B [illegible]

Transfers memory locations $1000 to $1400 from 8050 to CBM, starting at CBM location $2000

BLOCK TRANSFER CBM --> 8050

.B [illegible]

Transfers memory locations $2000 to $2400 from CBM to 8050, starting at 8050 location $1000

TRANSCRIBE SECTOR FROM DISK TO CBM

.B [illegible]

Reads track $27 sector $01 (hex) form drive #0 and deposits contents into CBM memory, starting at $1000

TRANSCRIBE SECTOR FROM CBM TO DISK

```
.W 0 1000 27 01
```

Writes 256 bytes from CBM memory starting at location $1000 to track $27 sector $01 on drive #0

READ SECTOR FROM DISK

```
.R 0 27 01
```

Reads track $27 sector $01 (hex) from drive #0 into buffer #0 (loc $1100 to $11FF in 8050)

WRITE SECTOR TO DISK

```
.W 0 27 01
```

Write buffer#0 (8050 locations $1100 to $11FF) to track $27 sector $01 on drive #0

INITIALIZE

```
.I 0
```

This command should preceede the first disk read or write operation

TRACK LINKADDRESSES

```
.T 0 26 17
26.0E   26.11    26.14   26.17   00.82

.
```

Prints pointers to consecutive sectors on the disk. Five sectors are linked in the example. Last sector is $17 on track $26. Note pointer to invalid sector (00.82) on last sector in chain.

SEND COMMAND STRING

```
.>S-M
00, OK,00,00

.
```

Sends commandstring to secondary address #15. Reads and displays error channel.

8050 MEMORY DISPLAY

```
.M E000
.$: E000 D1 A5 16 8D 3D 43 20 81
.$: E008 C5 8E 3B 43 AE 00 43 AD
.$: E010 3D 43 D0 29 E0 2A D0 25
.
```

Display 8050 memory from $E000 to $E017.

Bytes, unless in ROM, following the address may be modified by editing and then typing a carriage return.

HELP

```
.H
```

Displays the disk monitor's instruction set.

```
                    EXIT TO BASIC

          .X

Return to basic ready mode. The stack value saved when  entered  will  be
restored. Care should be taken that this value is the same  as  when  the
monitor was entered. A "CLR" in basic will fix any stack problems.

                  MONITOR INSTRUCTIONS

G go run
L load from tape
M memory display
R register display
S save to tape
X exit to basic

                  EXTRAMON INSTRUCTIONS

A simple assembler
B break set
D disassembler
E enable stop keys
F fill memory
H hunt memory
I integerate memory
N new locater
Q quick trace
T transfer memory
U undo stop keys
W walk code

                  DISKMON INSTRUCTIONS

>G set block from 8050
>P put block into 8050
>F fetch sector
>D dump to sector
>R read sector
>W write sector
>I initialize
>T track linkaddresses
>S send commandstring to 8050
>M display 8050 memory
>H display diskmon instruction set

                      *  E N D  *
```

How to type it in

As you can see, there's an awful lot of code to be typed in. If you've already got Extramon, or have access to it, life isn't quite so bad (you can just about forget the first 12 blocks), but if you haven't we'll just have to start at the beginning (*see later for an easier method!)

Enter the monitor with SYS 1024 (RETURN), type in M 7200 72B0 (RETURN), and a screen full of miscellaneous numbers and letters will appear. Cursor back to the top of the screen, and just type in the values given in the first block of numbers. Don't forget to press RETURN at the end of each line.

When you've finished the first lot, on we go to table two with M 72B8 7368, and type in the values again. Carry on in this fashion until you've got to the end of block 12 (M 7930 79E0), and then type in just the first two lines of block 13. Display them with M 79E8 79F0, and put in the new values.

This we will now save (you may not realise it but, bar four bytes, you've just typed in Extramon!) from the monitor, so type S "O:EXMON,08,7200,79F8 (RETURN), assuming you're using drive 0 of a disk drive numbered device 8.

Extramon alone

Before we carry on and enter the code for the disk part of the program, we'll give you the necessary changes to convert what you've just typed into a working version of Extramon.

Exit the monitor by typing X (return), and enter the following line in direct mode:

```
POKE 29207,182:POKE 29208,180:POKE
     31224,56:POKE 31225,114
```

Back into the monitor (SYS 1024) and save as before, but using a different name.

Don't try running it yet, we'll get the rest of the code in first.

If you already have Extramon on disk or tape, load it as per normal, and if you have the relocatable one, typing SYS 2654,122 will set it into the right area of memory. We need it to start at $7200 (decimal 29184). To make the necessary changes for Diskmon, enter the following line in direct mode:

```
POKE 29207,0:POKE 29208,122:POKE
     31224,14:POKE 31225,122
```

And onto Diskmon

Into the monitor, and enter the code from block 13 onwards. As usual, we've given it to you a screenful at a time to make it easier to enter.

Save all this from the monitor (S "0:DISKMON",08,7200,7FA2), and we'll check the code you've entered. There are bound to be mistakes in something of this size, so we'll try and break it down as much as possible.

If you think you've got it right, type in direct mode:

```
A = 0 : F O R I = 2 9 1 8 4 T 0 3 1 2 3 1 :
    A = A + PEEK(I) : NEXT : PRINTA
```

If the value you get for A is 396801 the impossible has happened and you've got it right! Either that, or a very odd coincidence has taken place. You'll soon find out if that's the case.

There are 13 blocks to check. Take the following program:

```
A = 0 : FORI = X TO Y : A = A + PEEK(I) : NEXT :
    PRINTA
```

where X and Y are the start and end addresses. The following table shows the values of X and Y for each block, and also the value of A that you should get. If your value differs, that's the block with the mistake, so go back and check that one very carefully against the printed listing.

Block #	X	Y	A
1	29184	29367	25768
2	29368	29551	24585
3	29552	29735	22881
4	29736	29919	22830
5	29920	30103	20106
6	30104	30287	23830
7	30288	30471	23782
8	30472	30655	21194
9	30656	30839	25010
10	30840	31023	22228
11	31024	31207	17195
12	31208	31391	24027
13	31392	31575	21738
14	31576	31759	18448
15	31760	31943	19153
16	31944	32127	19683
17	32128	32311	21095
18	32312	32495	11517
19	32496	32673	11731

Finally, it should all be correct, and we have a full, debugged, working version of Diskmon. It is initialised by typing SYS 7200, and away you go.

Extramon, if you typed in the necessary conversions, is initialised by the same command.

Easy way of entering program

We told you there was an easy way. Send us £10, specify what format disk you'd like it to be copied onto, and we'll send you a working copy of Diskmon (together with a separate and relocatable Extramon), along with full instructions for both. As an additional bonus, we'll throw in a relocatable version of Basic Aid (in the March issue) for you as well. £10 well spent!

```
1     7200 AD F8 79 AE F9 79 8D FA
      7208 03 8E FB 03 AD FA 79 AE
      7210 FB 79 85 34 86 35 20 00
      7218 7A A5 1F A6 20 18 69 02
      7220 85 2A 90 01 E8 86 2B 20
      7228 E9 B5 A2 00 BD CB 79 20
      7230 D2 FF E8 E0 0C D0 F5 00
      7238 A2 0E DD CB 79 D0 0E 86
      7240 B4 8A 0A AA BD DB 79 48
      7248 BD DA 79 48 60 CA 10 EA
      7250 30 33 A2 02 2C A2 00 B4
      7258 FB D0 08 B4 FC D0 02 E6
      7260 DE D6 FC D6 FB 60 A9 00
      7268 8D 00 01 20 98 D7 C9 20
      7270 F0 F9 20 6B D7 20 57 D7
      7278 90 0B 60 20 98 D7 20 54
      7280 D7 A6 FC B0 E0 4C A4 D7
      7288 A9 00 85 B8 20 C2 73 A2
      7290 09 20 31 D5 CA D0 FA 60
      7298 E6 FD D0 02 E6 FE 60 A2
      72A0 02 B5 FA 48 B5 D5 95 FA
      72A8 68 95 D5 CA D0 F3 60 A5
      72B0 D6 A4 D7 4C BA 72 A5 FD
```

2

```
72B8 A4 FE 38 E5 FB 85 CF 98
72C0 E5 FC A8 05 CF 60 20 D5
72C8 78 90 15 A6 DE D0 61 20
72D0 AF 72 90 5C A1 FB 81 FD
72D8 20 98 72 20 39 D5 D0 EB
72E0 20 AF 72 18 A5 CF 65 FD
72E8 85 FD 98 65 FE 85 FE 20
72F0 9F 72 A6 DE D0 3A A1 FB
72F8 81 FD 20 AF 72 B0 31 20
7300 52 72 20 55 72 4C F2 72
7308 20 D1 75 20 7B 72 20 44
7310 D7 20 98 D7 20 63 D7 90
7318 14 85 B5 A6 DE D0 11 20
7320 B6 72 90 0C A5 B5 81 FB
7328 20 39 D5 D0 EE 4C A4 D7
7330 4C BA D4 20 D1 75 20 7B
7338 72 20 44 D7 20 98 D7 A2
7340 00 20 98 D7 C9 27 D0 14
7348 20 98 D7 9D 0B 02 E8 20
7350 CF FF C9 0D F0 22 E0 20
7358 D0 F1 F0 1C 8E 00 01 20
7360 6B D7 90 C9 9D 0B 02 E8
7368 20 CF FF C9 0D F0 09 20
```

3

```
7370 63 D7 90 B9 E0 20 D0 EC
7378 86 B4 20 34 D5 A2 00 A0
7380 00 B1 FB DD 0B 02 D0 0C
7388 C8 E8 E4 B4 D0 F3 20 17
7390 D7 20 31 D5 20 39 D5 A6
7398 DE D0 0A 20 35 F3 F0 05
73A0 20 B6 72 B0 D8 4C BA D4
73A8 20 99 75 20 B6 72 90 0D
73B0 A0 2C 20 88 72 20 1D 74
73B8 20 35 F3 D0 EE 20 24 77
73C0 D0 E3 20 79 D5 20 17 D7
73C8 20 31 D5 A2 00 A1 FB 20
73D0 34 74 48 20 7A 74 68 20
73D8 90 74 A2 06 E0 03 D0 12
73E0 A4 B6 F0 0E A5 FF C9 E8
73E8 B1 FB B0 1C 20 15 74 88
73F0 D0 F2 06 FF 90 0E BD 3E
73F8 79 20 1F 77 BD 44 79 F0
7400 03 20 1F 77 CA D0 D5 60
7408 20 28 74 AA E8 D0 01 C8
7410 98 20 15 74 8A 86 B4 20
7418 22 D7 A6 B4 60 A5 B6 20
7420 27 74 85 FB 84 FC 60 38
```

4

```
7428 A4 FC AA 10 01 88 65 FB
7430 90 01 C8 60 A8 4A 90 0B
7438 4A B0 17 C9 22 F0 13 29
7440 07 09 80 4A AA BD ED 78
7448 B0 04 4A 4A 4A 4A 29 0F
7450 D0 04 A0 80 A9 00 AA BD
7458 31 79 85 FF 29 03 85 B6
7460 98 29 8F AA 98 A0 03 E0
7468 8A F0 0B 4A 90 08 4A 4A
7470 09 20 88 D0 FA C8 88 D0
7478 F2 60 B1 FB 20 15 74 A2
7480 01 20 91 72 C4 B6 C8 90
7488 F1 A2 03 C0 03 90 F2 60
7490 A8 B9 4B 79 85 D6 B9 8B
7498 79 85 D7 A9 00 A0 05 06
74A0 D7 26 D6 2A 88 D0 F8 69
74A8 3F 20 D2 FF CA D0 EC 4C
74B0 31 D5 20 66 72 A9 03 20
74B8 1F 75 A9 2C A8 4C C4 76
74C0 A5 90 A6 91 CD FC 79 D0
74C8 03 EC FD 79 60 20 C0 74
74D0 F0 25 8D 09 02 8E 0A 02
74D8 AD FC 79 AE FD 79 D0 0B
```

5

```
74E0 20 C0 74 D0 12 AD 09 02
74E8 AE 0A 02 78 85 90 86 91
74F0 8D 08 02 8E 07 02 58 4C
74F8 BA D4 20 12 75 D0 05 A9
7500 53 4C 7D D4 6C 09 02 AD
7508 12 E8 CD 12 E8 D0 F8 C9
7510 6F 60 20 07 75 D0 07 20
7518 07 75 F0 FB A9 00 60 85
7520 B5 48 20 98 D7 20 0B D5
7528 D0 F8 68 49 FF 4C 1F 74
7530 20 99 75 A6 DE D0 0D 20
7538 B6 72 90 08 20 47 75 20
7540 35 F3 D0 EF 4C BD 73 20
7548 34 D5 A2 2E A9 27 20 31
7550 D7 20 31 D5 20 17 D7 A9
7558 08 48 20 F7 D4 68 20 2B
7560 75 A9 12 20 D2 FF A0 08
7568 A2 00 A1 FB 29 7F C9 20
7570 B0 02 A9 2E 20 D2 FF 20
7578 39 D5 88 D0 ED 60 20 66
7580 72 A9 08 20 1F 75 20 24
7588 77 20 47 75 8C 6F 02 A9
7590 27 8D 70 02 A9 20 4C D5
```

6

```
7598 76 20 D1 75 20 CF FF C9
75A0 0D F0 1F C9 30 B0 1B 20
75A8 63 D7 90 16 85 FC A9 00
75B0 8D 00 01 20 CF FF 20 16
75B8 77 B0 07 20 78 D7 85 FB
75C0 B0 06 A9 FF 85 FB 85 FC
75C8 20 44 D7 4C 34 D5 4C A4
75D0 D7 20 66 72 4C 44 D7 20
75D8 D1 75 A2 00 8E 0C 02 20
75E0 98 D7 C9 20 F0 F4 95 C7
75E8 E8 E0 03 D0 F2 CA 30 13
75F0 B5 C7 38 E9 3F A0 05 4A
75F8 6E 0C 02 6E 0B 02 88 D0
7600 F6 F0 EA A2 02 20 CF FF
7608 C9 0D F0 22 C9 3A F0 1E
7610 C9 20 F0 F1 20 16 77 B0
7618 0F 20 78 D7 A4 FB 84 FC
7620 85 FB A9 30 9D 0B 02 E8
7628 9D 0B 02 E8 D0 D7 86 D6
7630 A2 00 86 DE A2 00 86 B5
7638 A5 DE 20 34 74 A6 FF 86
7640 D7 AA BD 8B 79 20 FB 76
7648 BD 4B 79 20 FB 76 A2 06
```

7

```
7650 E0 03 D0 12 A4 B6 F0 0E
7658 A5 FF C9 E8 A9 30 B0 1D
7660 20 F8 76 88 D0 F2 06 FF
7668 90 0E BD 3E 79 20 FB 76
7670 BD 44 79 F0 03 20 FB 76
7678 CA D0 D5 F0 06 20 F8 76
7680 20 F8 76 A5 D6 C5 B5 F0
7688 03 4C 06 77 20 44 D7 A4
7690 B6 F0 2A A5 D7 C9 9D D0
7698 1C 20 B6 72 90 09 98 D0
76A0 6C A6 CF 30 68 10 07 C8
76A8 D0 63 A6 CF 10 5F CA CA
76B0 8A A4 B6 D0 03 B9 FC 00
76B8 91 FB 88 D0 F8 A5 DE 91
76C0 FB A9 41 A8 8D 6F 02 20
76C8 24 77 20 88 72 20 1D 74
76D0 A9 20 8D 70 02 8D 71 02
76D8 8D 76 02 A5 FC 20 29 77
76E0 8E 72 02 8D 73 02 A5 FB
76E8 20 29 77 8E 74 02 8D 75
76F0 02 A9 08 85 9E 4C BA D4
76F8 20 FB 76 86 B4 A6 B5 DD
7700 0B 02 F0 0C 68 68 E6 DE
```

8

```
7708 F0 03 4C 34 76 4C A4 D7
7710 E8 86 B5 A6 B4 60 C9 30
7718 90 03 C9 47 60 38 60 C5
7720 B8 F0 FB 2C A9 91 4C D2
7728 FF 48 4A 4A 4A 4A 20 3A
7730 D7 AA 68 29 0F 4C 3A D7
7738 D8 20 C0 FC 58 68 8D 05
7740 02 68 8D 04 02 68 8D 03
7748 02 68 8D 02 02 68 8D 01
7750 02 68 8D 00 02 A5 90 8D
7758 08 02 A5 91 8D 07 02 BA
7760 8E 06 02 A5 B3 D0 1C AD
7768 00 02 CD 7B 02 D0 50 AD
7770 01 02 CD 7A 02 D0 48 AD
7778 7E 02 D0 40 AD 7F 02 D0
7780 38 C6 B3 20 34 D5 20 23
7788 D5 85 B5 A0 00 20 FE D4
7790 AD 01 02 AE 00 02 85 FB
7798 86 FC 20 31 D5 A9 24 85
77A0 B8 20 C5 73 20 35 F3 C9
77A8 F7 F0 F9 20 35 F3 D0 03
77B0 4C BA D4 C9 FF F0 F4 D0
77B8 39 CE 7F 02 CE 7E 02 20
```

9

```
77C0 12 75 D0 2E A2 53 4C B1
77C8 D4 AD 7C 02 AE 7D 02 8D
77D0 7E 02 8E 7F 02 A9 00 2C
77D8 A9 FF 85 B3 20 CF FF C9
77E0 0D F0 0C C9 20 D0 30 20
77E8 54 D7 90 2B 20 EC D4 20
77F0 34 D5 78 A9 A0 8D 4E E8
77F8 CE 13 E8 2C 12 E8 AD FE
7800 79 AE FF 79 8D 08 02 8E
7808 07 02 A9 3E A2 00 8D 48
7810 E8 8E 49 E8 4C 46 D6 4C
7818 A4 D7 20 99 75 A5 FB A6
7820 FC 8D 7A 02 8E 7B 02 A5
7828 FD A6 FE C9 FF D0 06 E0
7830 FF D0 02 E8 8A 8D 7C 02
7838 8E 7D 02 4C BA D4 20 D5
7840 78 86 B8 A5 FB 48 A5 FC
7848 48 20 7B 72 85 C7 86 C8
7850 20 7B 72 85 C9 86 CA 20
7858 CF FF C9 0D F0 09 20 CF
7860 FF C9 57 D0 02 E6 B8 68
7868 85 FC 68 85 FB A6 DE D0
7870 CA 20 AF 72 90 C5 A4 B8
```

10

```
7878 D0 23 B1 FB F0 4B 91 FD
7880 20 34 74 AA BD 4B 79 D0
7888 05 20 88 72 F0 AD A4 B6
7890 C0 02 F0 0B B1 FB 91 FD
7898 88 D0 F9 F0 2C 84 B6 88
78A0 38 B1 FB AA E5 C7 C8 B1
78A8 FB E5 C8 90 0A 88 A5 C9
78B0 F1 FB C8 A5 CA F1 FB B1
78B8 FB 90 08 48 8A E5 DA AA
78C0 68 E5 DB 91 FD 88 8A 91
78C8 FD 20 39 D5 20 98 72 C6
78D0 B6 10 F6 30 98 20 D1 75
78D8 20 7B 72 20 9F 72 20 7B
78E0 72 20 B6 72 A5 CF 85 DA
78E8 84 DB 4C 44 D7 40 02 45
78F0 03 D0 08 40 09 30 22 45
78F8 33 D0 08 40 09 40 02 45
7900 33 D0 08 40 09 40 02 45
7908 B3 D0 08 40 09 00 22 44
7910 33 D0 8C 44 00 11 22 44
7918 33 D0 8C 44 9A 10 22 44
7920 33 D0 08 40 09 10 22 44
7928 33 D0 08 40 09 62 13 78
```

11

```
7930 A9 00 21 81 82 00 00 59
7938 4D 91 92 86 4A 85 9D 2C
7940 29 2C 23 28 24 59 00 58
7948 24 24 00 1C 8A 1C 23 5D
7950 8B 1B A1 9D 8A 1D 23 9D
7958 8B 1D A1 00 29 19 AE 69
7960 A8 19 23 24 53 1B 23 24
7968 53 19 A1 00 1A 5B 5B A5
7970 69 24 24 AE AE A8 AD 29
7978 00 7C 00 15 9C 6D 9C A5
7980 69 29 53 84 13 34 11 A5
7988 69 23 A0 D8 62 5A 48 26
7990 62 94 88 54 44 C8 54 68
7998 44 E8 94 00 B4 08 84 74
79A0 B4 28 6E 74 F4 CC 4A 72
79A8 F2 A4 8A 00 AA A2 A2 74
79B0 74 74 72 44 68 B2 32 B2
79B8 00 22 00 1A 1A 26 26 72
79C0 72 88 C8 C4 CA 26 48 44
79C8 44 A2 C8 41 42 44 45 46
79D0 48 49 4E 51 54 55 57 27
79D8 2C 5A D6 75 19 78 A7 73
79E0 CC 74 07 73 32 73 2F 75
```

12

```
79E8 3D 78 C8 77 C5 72 DF 74
79F0 D7 77 7D 75 B1 74 FF FF
79F8 0E 7A 00 72 FA 74 38 77
7A00 20 B6 B4 A9 0D 20 D2 FF
7A08 A9 24 20 D2 FF 60 C9 24
7A10 F0 03 4C 38 72 A2 35 B5
7A18 00 9D B0 7F CA 10 F8 20
7A20 98 D7 C9 20 F0 F9 A2 0B
7A28 DD E0 7D D0 0C 8A 0A AA
7A30 BD F1 7D 48 BD F0 7D 48
7A38 60 CA 10 EC 4C A4 D7 EA
7A40 A9 00 85 45 20 15 F2 C9
7A48 20 F0 F9 C9 2C F0 F5 C9
7A50 0D D0 01 60 A2 04 DD 10
7A58 7E D0 17 8A 0A AA BD 15
7A60 7E 85 3A BD 16 7E 85 3B
7A68 20 63 D7 A0 00 91 3A 4C
7A70 44 7A CA 10 E1 4C A4 D7
7A78 20 7E 7A 4C 54 D7 20 98
7A80 D7 C9 20 F0 07 C9 2C F0
7A88 03 4C A4 D7 60 86 02 A9
7A90 28 85 D4 A9 6F 85 D3 20
7A98 D5 F0 A5 D3 20 43 F1 A2
```

13

```
7AA0 00 B5 46 20 9E F1 E8 C6
7AA8 02 10 F6 4C C7 7D A9 48
7AB0 85 D4 20 D2 F0 A9 6F 20
7AB8 93 F1 4C C0 F1 20 36 7C
7AC0 A5 2C 85 49 A5 2D 85 4A
7AC8 A2 04 20 8D 7A 20 AE 7A
7AD0 A0 00 91 30 E6 30 D0 02
7AD8 E6 31 20 F9 7A 90 01 60
7AE0 E6 2C D0 DC E6 2D 4C C0
7AE8 7A 20 34 D5 20 AE 7A 20
7AF0 66 F2 C9 0D D0 F6 4C CE
7AF8 7D 38 A5 2C E5 2E A5 2D
7B00 E5 2F 60 20 7E 7B 20 BD
7B08 7A 4C CE 7D 20 7E 7B 20
7B10 31 7B 4C CE 7D 20 40 7A
7B18 A9 80 20 A4 7B 20 E9 7A
7B20 4C CE 7D 20 40 7A A9 90
7B28 20 A4 7B 20 E9 7A 4C CE
7B30 7D 20 43 7C E6 2E D0 02
7B38 E6 2F A5 30 85 49 A5 31
7B40 85 4A A2 06 A0 00 B1 2C
7B48 95 46 E6 2C D0 02 E6 2D
7B50 20 F9 7A 90 02 B0 1C E0
```

14

```
7B58 27 B0 03 E8 D0 E8 A9 22
7B60 85 4B 20 8D 7A A5 30 18
7B68 69 22 85 30 90 02 E6 31
7B70 4C 3A 7B 86 02 8A 38 E9
7B78 06 85 4B 4C 8D 7A 20 8D
7B80 7B 20 78 7A A5 FB 85 30
7B88 A5 FC 85 31 60 20 78 7A
7B90 A5 FB 85 2C A5 FC 85 2D
7B98 20 78 7A A5 FB 85 2E A5
7BA0 FC 85 2F 60 85 3E 20 43
7BA8 7C A5 44 20 08 7C 18 69
7BB0 02 85 49 86 4A A9 02 85
7BB8 4B A5 3F 85 4C A5 42 85
7BC0 4D A2 07 20 8D 7A A5 44
7BC8 20 11 7C 85 49 86 4A A9
7BD0 01 85 4B A5 3F 85 4C A2
7BD8 06 20 8D 7A A5 44 20 4B
7BE0 7C 85 49 86 4A A9 01 85
7BE8 4B A5 43 29 01 05 3E 85
7BF0 4C A2 06 20 8D 7A 20 17
7BF8 7C C9 01 D0 01 60 20 2E
7C00 7C C6 45 10 D7 4C CE 7D
7C08 0A 0A 0A 18 69 21 A2 10
```

15

```
7C10 60 18 69 12 A2 10 60 20
7C18 36 7C A5 44 20 4B 7C 85
7C20 49 86 4A 20 BF 7D 20 AE
7C28 7A 09 00 30 F6 60 48 20
7C30 34 D5 68 4C 22 D7 A9 4D
7C38 85 46 A9 2D 85 47 A9 52
7C40 85 48 60 20 36 7C A9 57
7C48 85 48 60 18 69 03 A2 10
7C50 60 20 40 7A A9 00 85 44
7C58 A9 B0 20 A4 7B 20 34 D5
7C60 A9 80 20 A4 7B A9 00 85
7C68 2C A9 11 85 2D 85 2F A9
7C70 02 85 2E A9 0D 85 30 A9
7C78 00 85 31 20 BD 7A A5 0D
7C80 85 3F 20 22 D7 A9 2E 20
7C88 66 F2 A5 0E 85 42 20 22
7C90 D7 20 31 D5 20 31 D5 20
7C98 31 D5 A5 3F D0 C2 4C CE
7CA0 7D A2 00 20 15 F2 C9 0D
7CA8 F0 05 95 46 E8 D0 F4 CA
7CB0 20 8D 7A 4C E9 7A A9 00
7CB8 85 44 20 40 7A A9 B0 D0
7CC0 2A 20 78 7A A5 FB 85 2C
```

16

```
7CC8 85 2E A5 FC 85 2D 85 2F
7CD0 E6 2F A9 00 85 30 A9 11
7CD8 85 31 20 40 7A A9 00 85
7CE0 44 20 31 7B A9 B0 20 A4
7CE8 7B A9 90 20 A4 7B 4C E9
7CF0 7A 20 78 7A A5 FB 85 30
7CF8 A5 FC 85 31 20 40 7A A9
7D00 00 85 44 A9 B0 20 A4 7B
7D08 A9 80 20 A4 7B A9 00 85
7D10 2C 85 2E A9 11 85 2D 85
7D18 2F E6 2F 20 BD 7A 4C CE
7D20 7D 20 8D 7B A5 2E 85 32
7D28 A5 2F 85 33 A5 2C 18 69
7D30 08 85 2E A5 2D 69 00 85
7D38 2F A9 0D 85 30 A9 00 85
7D40 31 20 34 D5 A9 2E 20 66
7D48 F2 A9 24 20 66 F2 A9 3A
7D50 20 66 F2 20 31 D5 A5 2D
7D58 20 22 D7 A5 2C 20 22 D7
7D60 20 BD 7A A2 00 86 3A 20
7D68 31 D5 A6 3A B5 0D 20 22
7D70 D7 E6 3A A5 3A C9 08 D0
7D78 EE 38 A5 2E E5 32 A5 2F
```

17

```
7D80 E5 33 90 A8 4C CE 7D 20
7D88 78 7A A5 FB 85 30 A5 FC
7D90 85 31 A9 00 85 3A 20 B9
7D98 7D A6 3A 95 17 E6 3A A5
7DA0 3A C9 08 D0 F1 A9 17 85
7DA8 2C A9 1F 85 2E A9 00 85
7DB0 2D 85 2F 20 31 7B 4C CE
7DB8 7D 20 7E 7A 4C 63 D7 A2
7DC0 04 86 02 20 8F 7A 60 A9
7DC8 4C 85 51 4C B9 F1 A2 35
7DD0 BD B0 7F 95 00 CA 10 F8
7DD8 20 AE F1 4C BA D4 AA AA
7DE0 52 57 47 50 56 3A 3E 49
7DE8 54 46 44 48 AA AA AA AA
7DF0 14 7B 22 7B 02 7B 0B 7B
7DF8 20 7D 86 7D A0 7C B5 7C
7E00 50 7C F0 7C C0 7C 1F 7E
7E08 AA AA AA AA AA AA AA AA
7E10 54 53 44 4A 52 3F 00 42
7E18 00 43 00 44 00 45 00 AA
7E20 A9 3C 85 21 A9 7E 85 22
7E28 A9 00 A8 B1 21 F0 0B 20
7E30 D2 FF E6 21 D0 F5 E6 22
```

18

```
7E38 D0 F1 4C BA D4 93 20 20
7E40 20 20 20 20 20 20 20 20
7E48 20 20 20 20 20 20 20 20
7E50 13 0D 20 20 20 20 20 20
7E58 20 12 2A 20 44 49 53 4B
7E60 4D 4F 4E 20 2A 92 0D 0D
7E68 20 0D 12 47 92 45 54 20
7E70 42 4C 4F 43 4B 20 46 52
7E78 4F 4D 20 38 30 35 30 20
7E80 54 4F 20 43 42 4D 0D 12
7E88 50 92 55 54 20 42 4C 4F
7E90 43 4B 20 46 52 4F 4D 20
7E98 43 42 4D 20 54 4F 20 38
7EA0 30 35 30 0D 12 46 92 45
7EA8 54 43 48 20 44 2F 54 2F
7EB0 53 20 46 52 4F 4D 20 44
7EB8 49 53 4B 20 54 4F 20 43
7EC0 42 4D 0D 12 44 92 55 4D
7EC8 50 20 42 4C 4F 43 4B 20
7ED0 54 4F 20 44 2F 54 2F 53
7ED8 0D 12 49 92 4E 49 54 49
7EE0 41 4C 49 5A 45 20 28 42
7EE8 45 46 4F 52 45 20 52 45
```

19

```
7EF0 41 44 6F 57 52 49 54 45
7EF8 29 20 0D 12 52 92 45 41
7F00 44 20 53 45 43 54 4F 52
7F08 20 49 4E 54 4F 20 42 55
7F10 46 46 45 52 20 28 24 31
7F18 31 30 30 2D 24 31 31 46
7F20 46 29 0D 12 57 92 52 49
7F28 54 45 20 42 55 46 46 45
7F30 52 20 54 4F 20 53 45 43
7F38 54 4F 52 0D 12 48 92 45
7F40 4C 50 20 28 49 4E 53 54
7F48 52 55 43 54 49 4F 4E 53
7F50 29 0D 12 3E 92 43 4F 4D
7F58 4D 41 4E 44 53 54 52 49
7F60 4E 47 0D 12 54 92 52 41
7F68 43 4B 20 4C 49 4E 4B 41
7F70 44 44 52 45 53 53 45 53
7F78 0D 12 56 92 20 45 44 49
7F80 54 0D 20 0D 12 24 92 20
7F88 50 52 45 43 45 45 44 45
7F90 53 20 45 56 45 52 59 20
7F98 43 4F 4D 4D 41 4E 44 0D
7FA0 0E 00 AA AA AA AA AA AA
```

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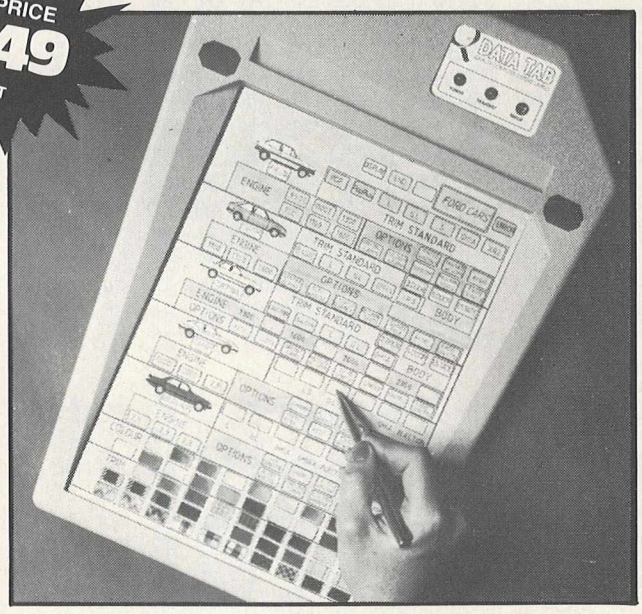

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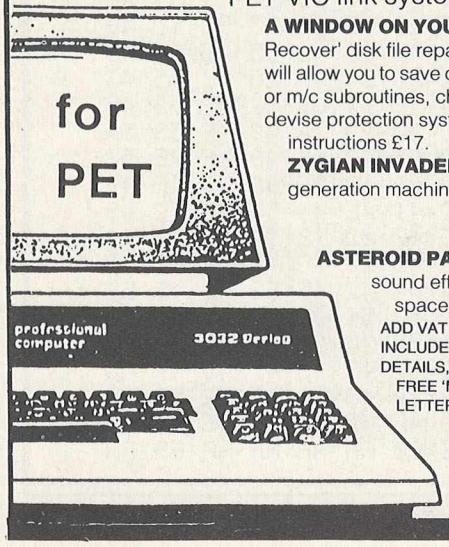

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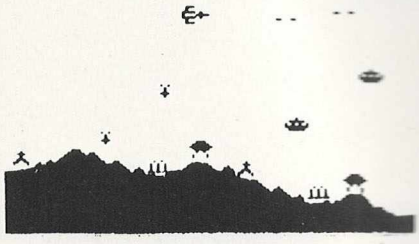

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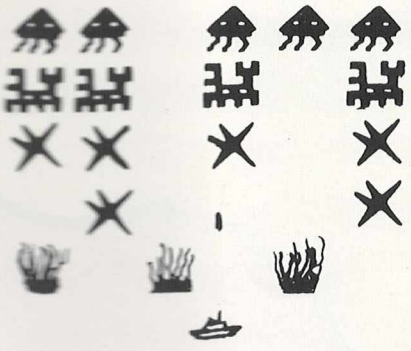

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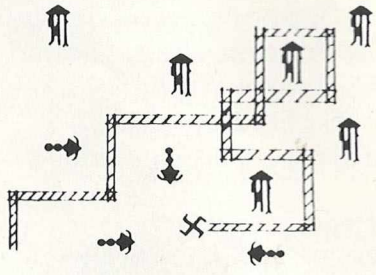

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